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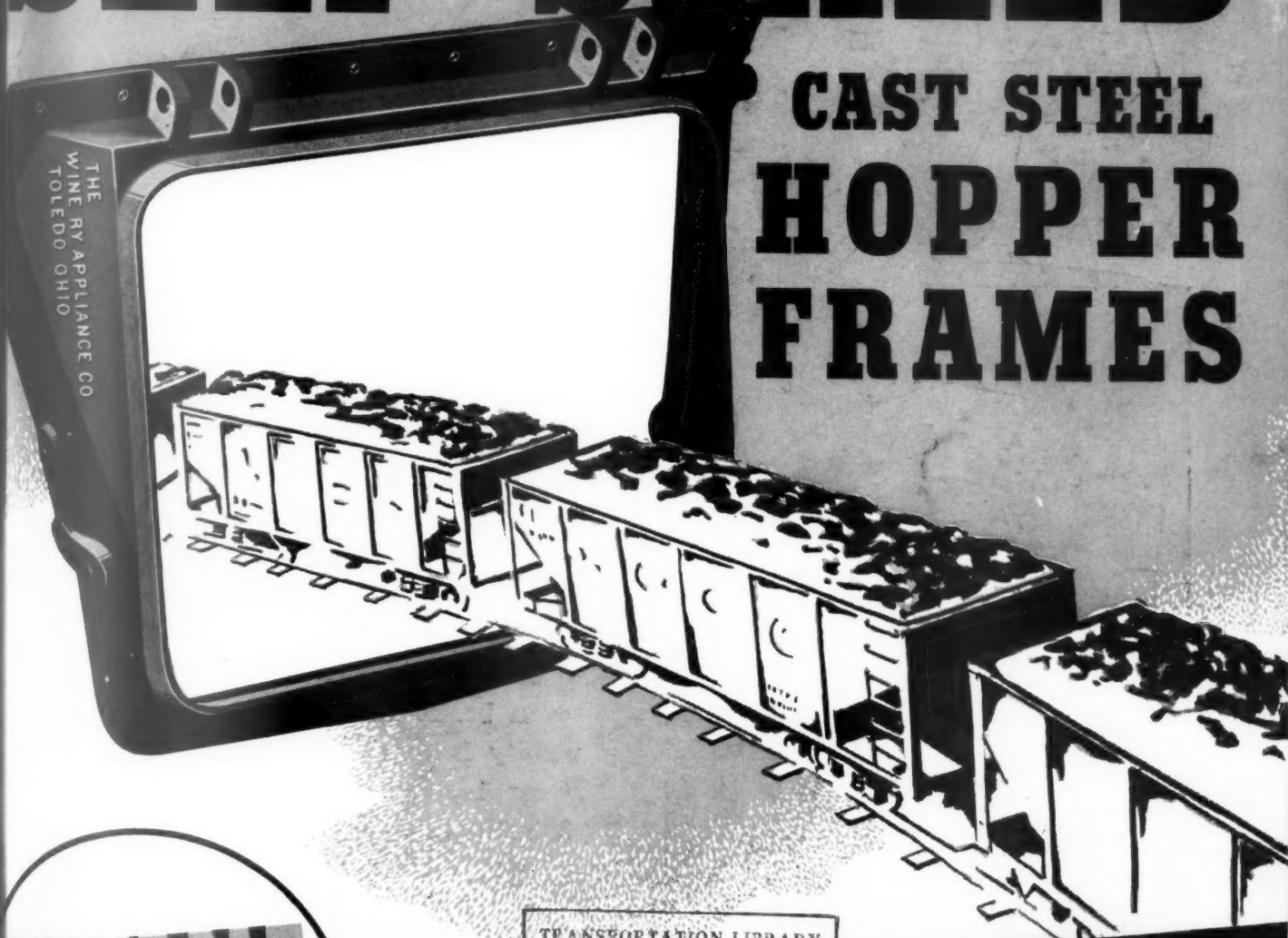
July ~~JUL~~ 13 1943
1943

Railway Mechanical Engineer

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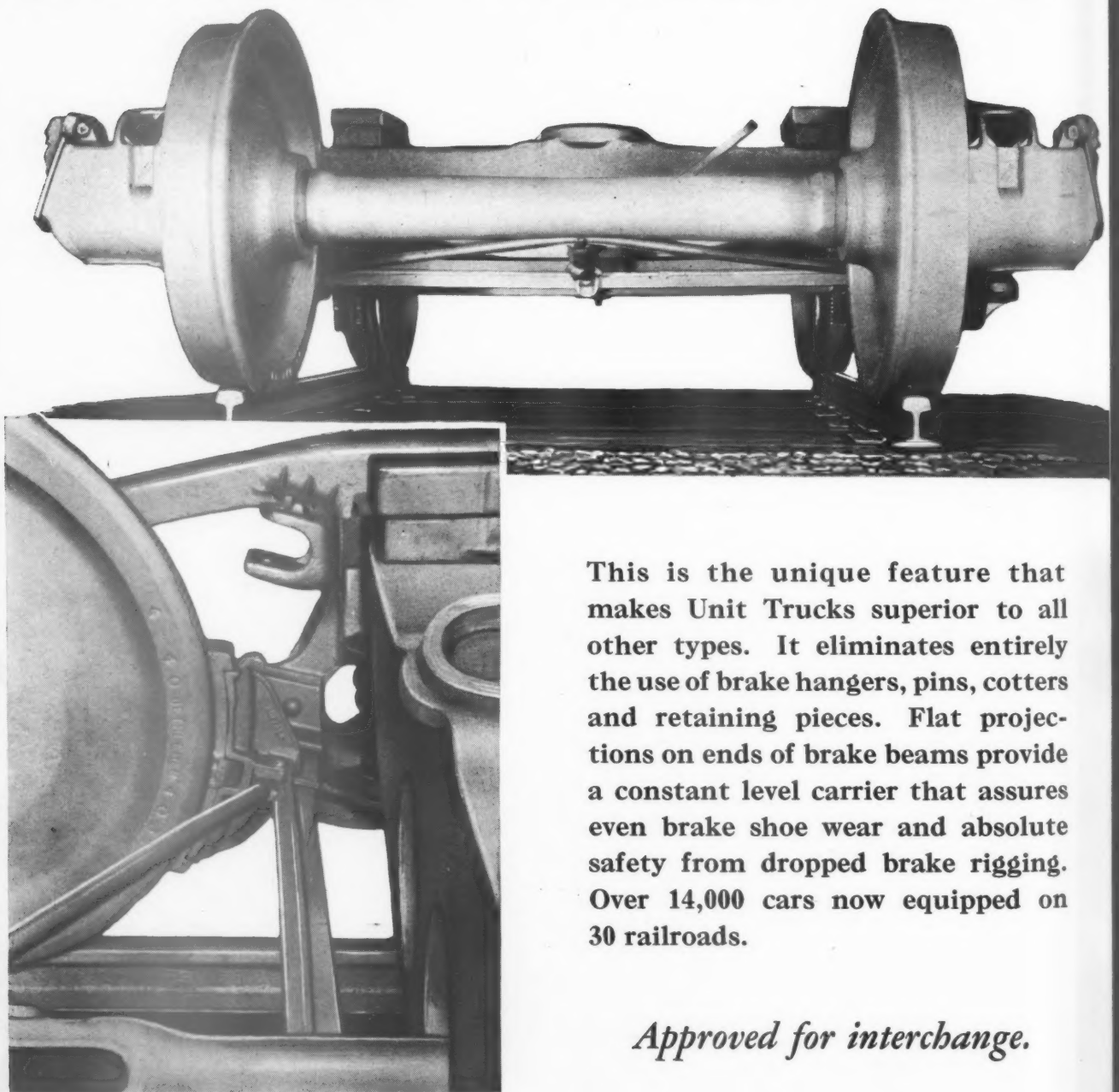
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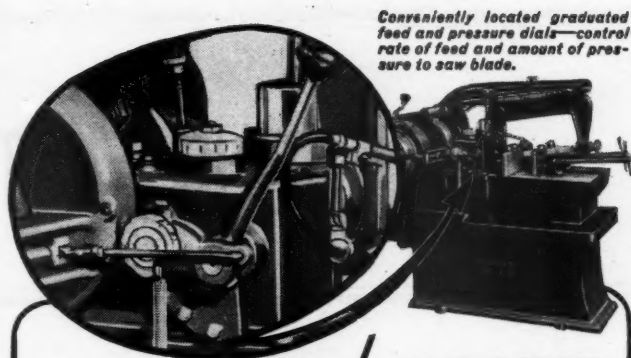
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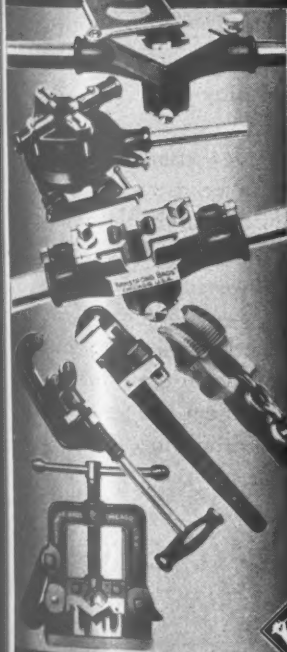


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THE EDITOR'S DESK

PRODUCTION MUST BE SPEEDED UP

Malicious propaganda, the effects of the so-called fluidity of war, and erroneous impressions on the part of the public regarding the size of the job still to be done, may greatly prolong the conflict and cause unnecessary loss of lives and property, if the war production program is thereby slowed down.

The enemy, like ourselves, is constantly experimenting and bringing out new equipment and more destructive devices. These sometimes mean that radical changes must be made in order successfully to meet and overcome these new developments. In turn, they may mean entirely discarding or radically redesigning a piece of armament or fighting equipment. It is not strange if the workers who may be temporarily displaced or left idle while the necessary changes in production are being made, feel that it is an indication of a permanent slowing down of war production. This is particularly true if it occurs at a time when the newspapers and radio are heralding victories or favorable progress for our side.

The war, however, will not be won that easily. The success in North Africa and in overcoming the islands in the Mediterranean is only the beginning of the great offensive, which almost certainly will extend over many months and possibly over years.

In the first six months of this year we achieved only about 40 per cent of the war production goal established for the year 1943. To achieve it fully, the rate of production during the second half of this year must be 50 per cent greater than during the first six months. There will be necessary slow-downs and idleness in some plants, where stern necessity has dictated that radical changes must

be made in the design or type of equipment which is being manufactured. It is reasonable to expect that if the pace as a whole is speeded up, however, we will reach the established goal, because new plants have come into operation during the first part of the year and further progress will undoubtedly be made in this direction throughout the rest of the year.

On the other hand, industry will suffer heavily from the withdrawal of skilled workers who must enter the services to bring our armed forces to the necessary size. The railroads, seriously as they have been handicapped for needed manpower, must make still further contributions to the building up of the railroad battalions and the other services.

One prominent officer in the Administration has pointed out that up to the first of this year we had spent within 10 per cent as much money for plant construction and equipment as we had for actual production of munitions and fighting equipment. With less materials and manpower required for plant construction and equipment, more will be available for the production of war materials, and we should make more rapid progress.

Our forces have thus far had a few conflicts, which may be likened to the minor bouts required to sharpen up the punch of a heavyweight champion in training for the big fight. When we do get into the real shooting, the piles of war supplies that we have been accumulating will dwindle mighty fast. We must fight desperately hard to make replacements, in order to give the boys at the front the necessary backing. Don't let them kid you into believing otherwise—the stakes are too vital.

Roy V. Wright

RAILWAY MECHANICAL ENGINEER

(Name Registered, U. S. Patent Office)
With which is incorporated the RAILWAY ELECTRICAL ENGINEER.

Founded in 1832 as the American Rail-Road Journal

JULY, 1943

Volume 117

No. 7

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High Spots in Railway Affairs

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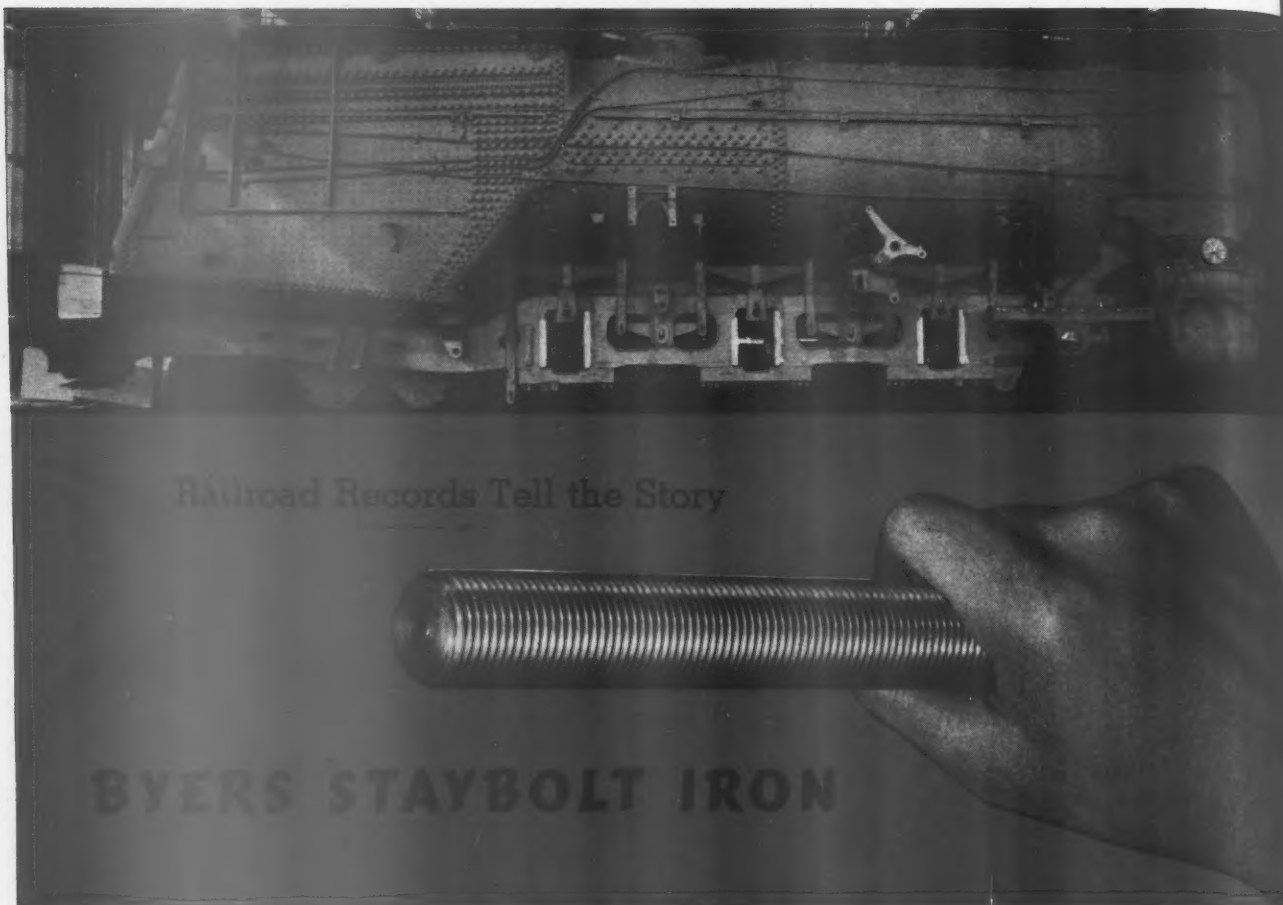
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They are written in terms of decreased manufacturing rejects, increased hours and miles between locomotive shoppings . . . like these examples . . .

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outer bend . . . and with no indication that the limit of stretch had even been approached. Failure of the other specimen occurred long before this point was reached.

A locomotive, in for class 3 repairs three years and two months after Byers Staybolts were installed, did not require a single replacement.

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RAILWAY MECHANICAL ENGINEER



D. M. & I. R. Locomotives

THE Duluth, Missabe & Iron Range took delivery, early this year, of 10 single-expansion articulated heavy freight locomotives which rank among the largest built for service in this country. These locomotives have a total weight: (engine and tender) of 1,132,000 lb. and a total wheel base, for the engine and tender, of 113 ft. 4 $\frac{3}{8}$ in. The tractive force is 140,000 lb. and the weight on drivers, 695,000 lb. In an accompanying table there is a comparison of the principal characteristics of this and other large articulated locomotives.

These locomotives, which bear the road numbers 228 to 237, are practically identical in design to an original order of eight, from the plant of the same builder, which were delivered in 1941. These 18 locomotives handle ore trains of 6,000 gross tons from the Vermilion and Mesabi Ranges in Minnesota to the docks at Duluth. The round trip runs require 12 and 10 hours, respectively. The 25,000 gallon tender tanks permit through one-way runs without water stops and the 26 tons of fuel is sufficient for a round trip. On the trip from mines to docks there are numerous adverse grades, the heaviest against load being 0.62 per cent for a distance of three miles. These new locomotives are capable of handling a 25 per cent increase in tonnage as compared with the converted Mallet compound power previously used.

The boiler is the straight-top type, 58 ft. 7 $\frac{1}{2}$ in. overall length. The barrel is constructed in three courses with sheet thicknesses of 1 $\frac{5}{16}$ in. and 1 $\frac{3}{8}$ in. The first course is 104 in. outside diameter. The front and back flue sheets are $\frac{3}{4}$ in. and $\frac{5}{8}$ in., respectively. The circumferential seams are triple riveted while the longitudinal seams are quintuple-riveted butt joints. Carbon-steel sheets are used throughout the barrel and firebox.

The firebox is 210 $\frac{1}{8}$ in. long and 102 $\frac{1}{4}$ in. wide with an 84-in. combustion chamber. The firebox and combustion chamber seams are all welded. The crown is designed with slope for 2.2 per cent grades.

There is a full installation of Flannery flexible staybolts in the combustion chamber, throat sheet, breaking zones of the side sheets and in the boundary rows of the

Articulated units are designed to haul 6,000-ton trains without the necessity of making fuel or water stops — Tractive force, 140,000 lb.; weight on drivers, 695,000 lb.

back head. Flannery rigid bolts are used in the water spaces.

Four syphons are used in the firebox and combustion chamber; one is located at the forward end of the firebox and one in the combustion chamber on the approximate center line of the boiler, while the remaining two at the rear of the firebox are about 14 in. right and left of the center line. The two rear syphons have their necks in the throat sheet and the other two at the approximate bottom center line of the combustion chamber. There are also two arch tubes and a Gaines wall in the firebox.

The superheater is a 124-unit Type E with American multiple throttle in the header. Five of the locomotives are equipped with Worthington 6 $\frac{1}{2}$ SA feedwater heaters of 14,400 gal. capacity; the other five are equipped with Elesco K 60 A heaters of 12,000 gal. capacity. All 10 locomotives have Sellers Type SY injectors of 12,000 gal. capacity, located on the left side.

Fuel is fed to the firebox by means of a Standard MB stoker. The grates are the Firebar type and the firedoor is the Franklin 8-A, with a 16-in. by 20-in. opening. The boilers are equipped with the Barco Type F3A low water alarm, Wilson blow-off cocks, mufflers and operating valves.

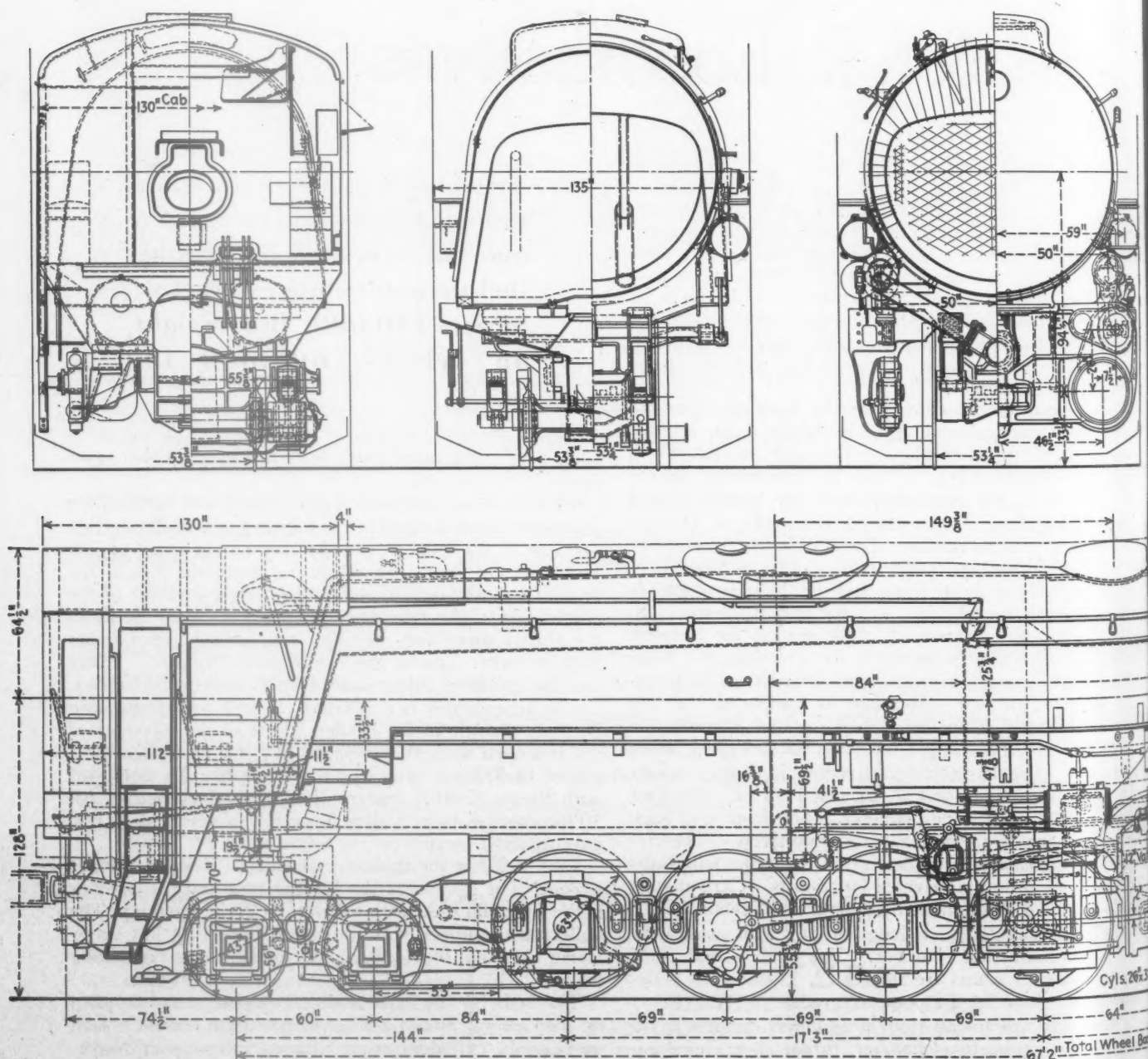
The beds for the front and rear engine units, supplied by the General Steel Castings Corporation, embrace such parts as the cylinders, front bumper, cab support, brake-cylinder brackets, reverse-shaft support, articulation

hinge, cradle and trailer rocker plates. The front and rear engine units are connected at the rear cylinders by a conventional articulation hinge. A single boiler bearing of the sliding shoe type, with centering device, is used

to transfer the weight of the boiler to the front engine. The leading engine truck is the General Steel Castings Commonwealth two-wheel type with inside roller bearings. This truck has a swing of 6¼ in. each side of the

Axles, Bearings, Wheel Centers and Tires

Location	Material	Manufacturer	Axles		Type	Material	Manufacturer	Tires		Manufacturer
			Type Bearings	Journal size, in.				Diameter in.	Diameter in.	
Front truck...	Carbon steel	Carnegie-Illinois	A.S.F.	.....	Multiple Wear	Wrought steel, heat treated	Carnegie-Illinois	..	36	....
Drivers, main..	Carbon steel	Carnegie-Illinois	Timken	12¾	Boxpok	Cast steel	Gen. Steel Castings Corp.	56	63	Alco-Ry. Steel Spring Div.
Drivers, other..	Carbon steel	Carnegie-Illinois	Timken	11¾	Boxpok	Cast steel	Gen. Steel Castings Corp.	56	63	Alco-Ry. Steel Spring Div.
Trailer, front...	Carbon steel	Carnegie-Illinois	A.S.F.	7x14	....	Cast steel	Standard Steel Works	36	43	....
Trailer, rear....	Carbon steel	Carnegie-Illinois	A.S.F.	7x14	....	Cast steel	Standard Steel Works	36	43	....
Tender trucks..	Carbon steel	Carnegie-Illinois	A.S.F.	6½x12	Multiple wear	Wrought steel, heat-treated	Carnegie-Illinois	..	42



Erecting elevation and cross sections of the D

engine.
ings
bear-
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center line. The trailer truck, supplied by the same manufacturer, is the four-wheel type with outside bearings. It is designed to swing $7\frac{3}{4}$ in. each side of the center line at the rear truck axle. Both leading and trailer trucks have auxiliary bearings; these being of bronze on the leading truck and of cast iron lined with Satco metal on the trailer truck. An accompanying table shows the type, sizes and material of the wheels, tires and axles for both the engine and the tender.

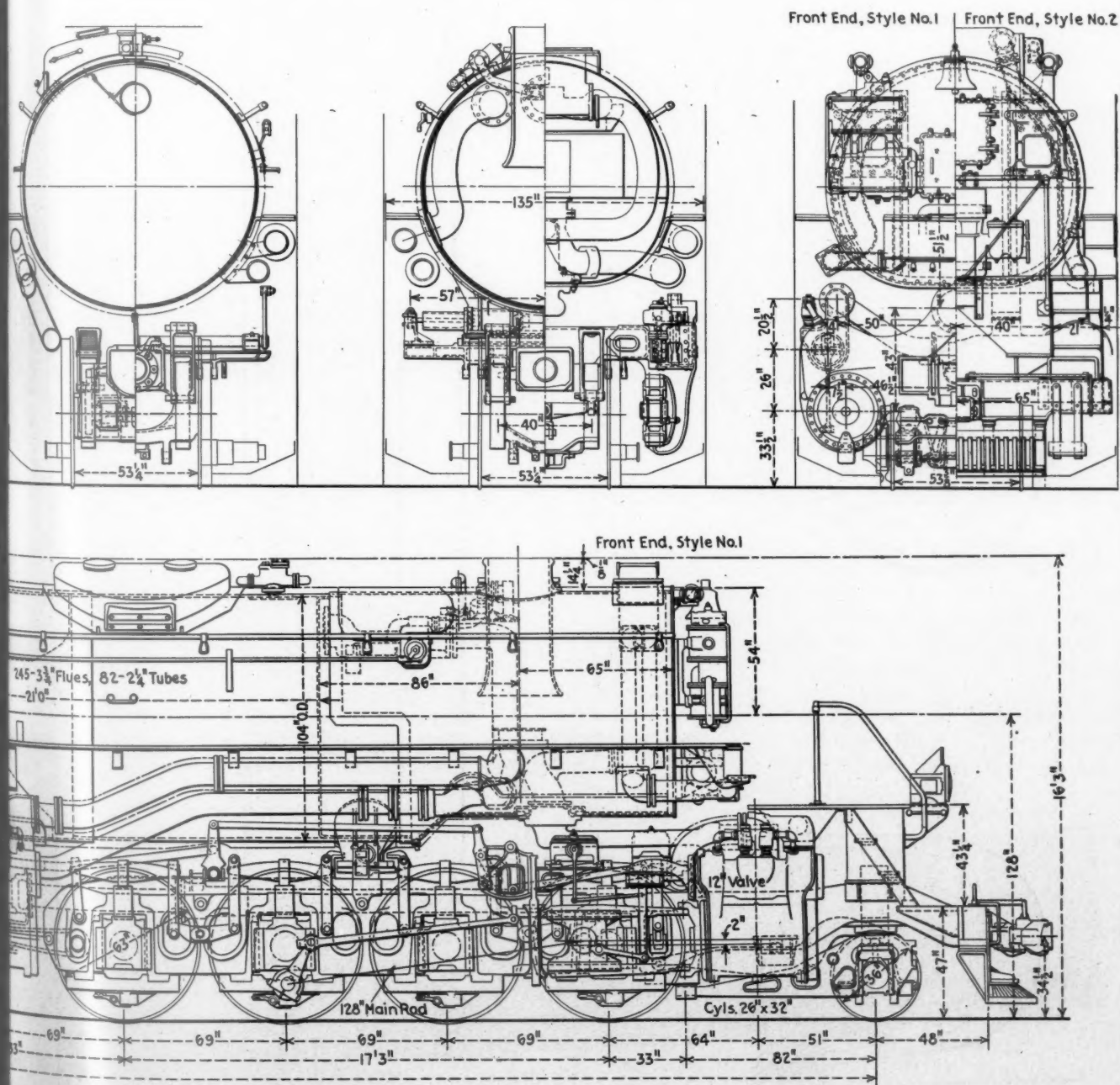
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Steel
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Steel
iv.

The cylinders, four in number, are 26 in. bore by 32 in. stroke. They have Hunt Spiller bushings—the pistons, piston rings, valves, valve rings and valve-chamber bushings were supplied by the same manufacturer. The valves for both front and rear engines are 12 in. diameter with 8 in. travel on the front engine and $7\frac{3}{4}$ in. on the rear engine. The Baker valve gear is controlled by a 12-in. Baldwin power reverse gear equipped with Transportation Devices Corporation reverse-gear valve for automatic cut-off control. The crossheads are the alli-

gator type, forged and flame trimmed, with Rogatchoff adjustable wedges and bronze shoes. The wrist pins are hollow-bored carbon steel. The main and side rods are carbon steel. Hollow-bored crank pins are used with floating bushings at the main pins and solid bushings at all other locations. The roller bearing housings for the driving wheel bearings are the split type. The Alco lateral motion device is used at the first, fourth and fifth drivers; $1\frac{1}{8}$ in. lateral is used at these locations and $\frac{3}{8}$ in. lateral at all other wheels. Franklin automatic compensators and snubbers are used on all drivers.

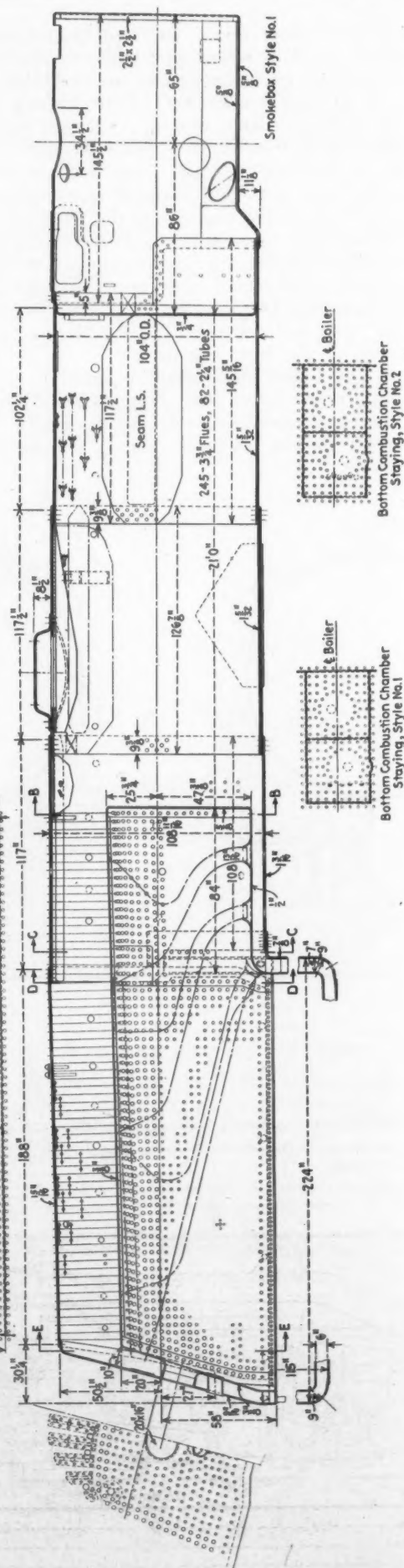
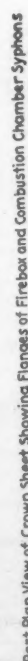
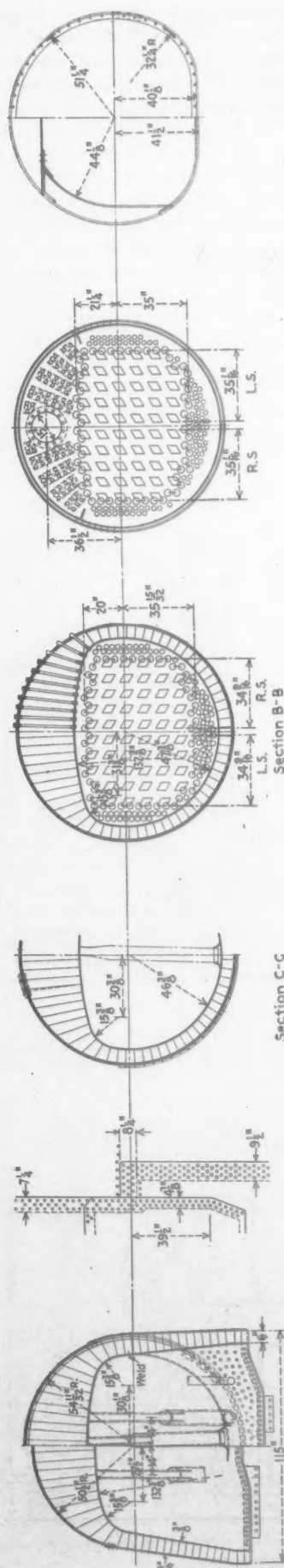
The weight of the reciprocating parts on one side of each engine unit is 2,382 lb. In the counterbalancing of these locomotives 46 per cent of the reciprocating weights are balanced—2,194 lb. on each side of the locomotive. There is an overbalance of 128 lb. at the main wheels and 323 at all other drivers. The unbalanced reciprocating weights are 3.67 per cent of the total weight of the locomotive in working order.



Missabe & Iron Range 2-8-8-4 type locomotive

Engineer
Y, 1943

Railway Mechanical Engineer
JULY, 1943



General Dimensions and Weights of the Duluth, Missabe & Iron Range 2-8-8-4 Locomotives

Builder	Baldwin Locomotive Works	Boiler, Continued:	
Type of locomotive	2-8-8-4	Firebox width, in.	102¾
Road class	M-4	Height, center line of boiler to crown sheet, back, in.	20
Road numbers	228-237	Height, center line of boiler to crown sheet, front, in.	25¾
Date built	March, 1943	Combustion chamber length, in.	84
Service	Freight	Syphons, number	5
Dimensions:		Tubes, number and diameter, in.	82 — 2¾
Height to top of stack, ft.-in.	16 — 3	Flues, number and diameter, in.	245 — 3¾
Height to center of boiler, ft.-in.	10 — 8	Length over tube sheets, ft.-in.	21 — 0
Width overall, ft.-in.	11 — 3	Net gas area through tubes and flues, sq. in. .	1,997.6
Cylinder centers, in.	93	Fuel	Bituminous coal
Weights in working order, lb.:		Grate area, sq. ft.	125
On drivers	565,000	Heating surfaces, sq. ft.:	
On front truck	41,350	Firebox	379
On trailing truck	93,350	Combustion chamber	177
Total engine	699,700	Arch tubes	32
Tender (fully loaded)	438,300	Syphons	138
Total engine and tender	1,138,000	Firebox, total	726
Wheel bases, ft.-in.:		Tubes	1,009
Driving	45 — 7	Flues	5,023
Rigid:		Evaporative, total	6,758
Front unit	5 — 9	Superheating	2,770
Back unit	11 — 6	Combined evap. and superheat.	9,528
Engine, total	67 — 2	Boiler proportions: (estimated)	
Engine and tender, total	113 — 4¾	Firebox heat. surface, per cent comb. heat. surface	7.6
Wheels, diameter outside tires, in.:		Tube-flue heat. surface, per cent comb. heat. surface	63.3
Driving	63	Superheater heating surface, per cent comb. heat. surface	29.1
Front truck	36	Firebox heat. surface + grate area	5.81
Trailing truck	43	Tube-flue heat. surface + grate area	48.26
General data:		Superheater heat. surface + grate area	22.2
Rated tractive force, engine 85 per cent, lb. .	140,000	Comb. heat. surface + grate area	76.2
Rated tractive force, booster, lb.	None	Gas area, tubes-flues + grate area	0.11
Speed at 1,000 ft. per min., piston speed, m.p.h.	35.1	Evaporative heat. surface + grate area	54.1
Piston speed at 10 m.p.h., ft. per min.	248.5	Tractive force + grate area	1,120.0
R.p.m. at 10 m.p.h.	53.3	Tractive force + evap. heat. surface	20.7
Engine:		Tractive force + comb. heat. surface	14.69
Cylinders, number, diameter and stroke, in. .	4 — 26 x 32	Tractive force x diameter drivers + comb. heat. surface	925.7
Valve gear, type	Baker	Weight proportions: (estimated)	
Valves:		Weight on drivers + weight engine, per cent	80.7
Piston type, diameter, in.	12	Weight on drivers + tractive force	4.04
Exhaust clearance, in.	Line and line	Weight of engine + evaporation	103.5
Maximum travel, front, in.	8	Weight of engine + comb. heat. surface	73.4
Maximum travel, back, in.	7¾	Tender:	
Steam lap, in.	1¾	Style	Rectangular
Lead, in.	¾/10	Water capacity, U. S. gal.	25,000
Cutoff in full gear, per cent, front	87	Fuel capacity, tons	26
Cutoff in full gear, per cent, back	86.3	Wheel diameter, in.	42
Boiler:			
Type	Straight top		
Steam pressure, lb. per sq. in.	240		
Diameter, first ring, inside, in.	101¼/10		
Firebox length, in.	210¾		

The spring rigging of these locomotives is of conventional design. On the front engine the spring rigging is continuous from the engine truck to the intermediate driver and is cross equalized. The main and rear drivers are equalized together on each side of the locomotive. On the rear engine the suspension is continuous on each side of the locomotive from the front driver to the rear trailer wheel. Coil buffer springs are used in the anchor hangers at the rear of the trailer truck. Case-hardened and ground bushings are used throughout the spring rigging; Fabreka pads are used under the spring ends.

Mechanical lubricators, four in number, with 36 feeds are located on the front and rear units. The parts lubricated by oil under pressure are: cylinders, valves, stoker, guides, valve-stem guides, feedwater pump, frame and truck pedestals, steam- and exhaust-pipe joints, compensators, hinge pins, furnace bearers and sliding plates. Grease lubrication with Alemite fittings is used for such parts as crosshead pins, eccentric rods, reverse-lever

guides, engine-truck center plate, side-rod knuckle pins, throttle rigging, valve-rod crossheads, lubricator rigging, crank pins, cushioning device, drawbar pins and tender vestibule.

The cab is the vestibule type of welded construction, completely insulated and weatherstripped. It is unusually roomy, being 130 in. wide and 112 in. long, at the deck. There are two seats on each side.

The locomotive brake equipment is Westinghouse No. 8ET with two 8½-in. cross-compound compressors located on brackets at the front of the smokebox. Four Wilson grid radiation elements are used for cooling. The driver brake is operated by 12-in. by 10-in. cylinders and has a braking ratio of 50 per cent at 50 lb. cylinder pressure.

Other equipment used on the locomotives includes TZ cylinder cocks and operating valves, Viloco cylinder by-pass valves, Locomotive Valve Pilot, A. S. F. type

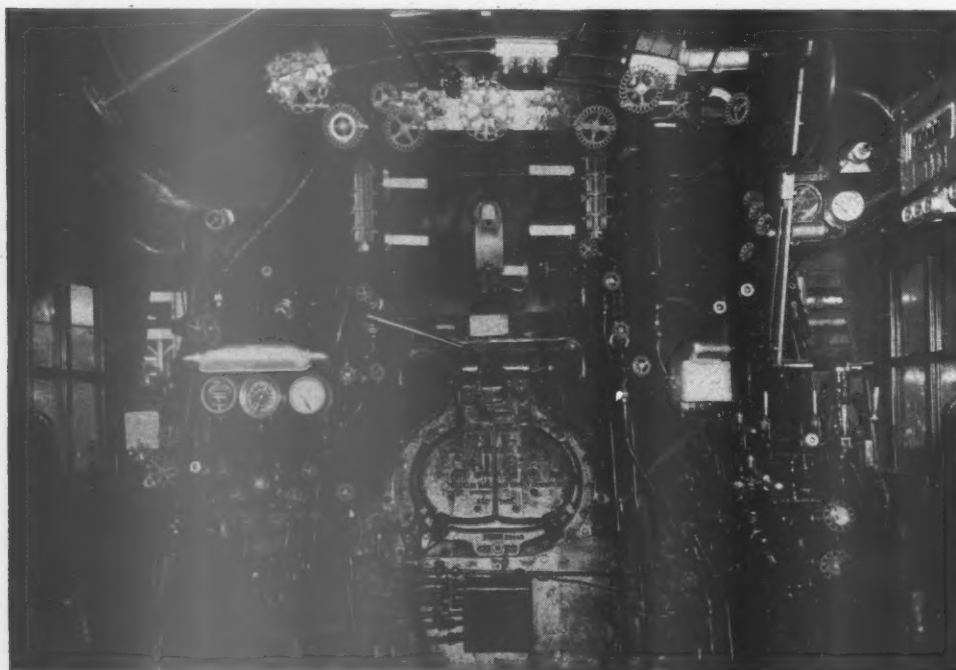


Exterior of one of the boilers

Comparative Characteristics of Large Six- and Eight-Coupled Locomotives

	D.M.I. & R. 2-8-8-4	Northern Pacific 2-8-8-4	West. Pac. 2-8-8-2	Union Pac. 4-8-8-4	Nor. & West. 2-6-6-4	C. & O. 2-6-6-6
Road class.....	M-4	Z5	M137-151	.....	A	H 8
Road numbers.....	228-237	5000	251-260	4000-4019	1200-1224	1600-1609
Builder.....	Baldwin	Alco	Baldwin	Alco	Co. shops	Lima
Date built.....	1943	1928	1937	1941	1936-'37-'43	1941
Service.....	Freight	Freight	Freight	Freight	Pass. & Frt.	Freight
Weight on driver, lb.*.....	565,000	554,000	549,656	540,000	432,350	471,000
Total engine, lb.*.....	699,700	715,000	663,100	762,000	573,000	724,500
Tender, lb.*.....	438,300	41,000	403,350	435,800	378,600	426,100
Cylinder, diameter and stroke in.....	(4) 26x32	(4) 26x32	(4) 26x32	(4) 23½x32	(4) 24x30	(4) 22½x31
Diameter, driving wheels, in.....	63	63	63	68	70	67
Steam pressure, lb.....	240	250	235	300	300	260
Fuel.....	Bituminous	Sub-bituminous	Oil	Bituminous	Bituminous	Bituminous
Grate area, sq. ft.....	125	182.0	145.0	150.3	122	135.2
Firebox heat. surf., total sq. ft.....	726	610	670	704	530	600
Evap. heat. surf., sq. ft.....	6,758	7,673	6,811	5,889	6,639	7,240
Super. surf., sq. ft.....	2,770	3,219	2,152	2,466	2,703	3,186
Tractive force, engine, lb.....	140,000	139,900	137,000	135,375	114,000	110,200
Tractive force, booster, lb.....	None	13,400	None	None	None	None
Fuel capacity, tons.....	26	27	6,000	28	26	25
Water capacity, gal.....	25,000	21,200	22,000	25,000	22,000	25,000

* Weights in working order.

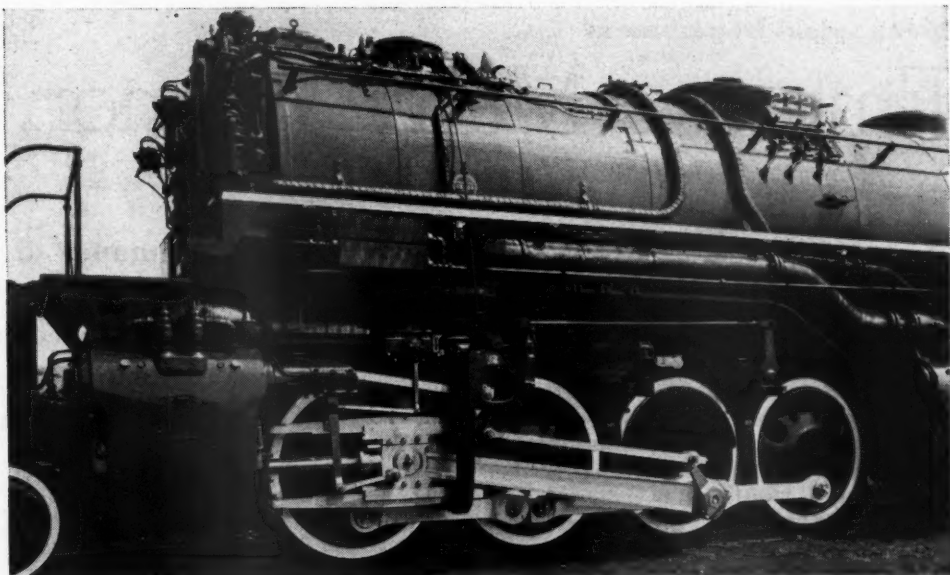


The cab is unusually large and the arrangement of controls and gauges on the backhead is convenient for the engine crew

Partial List of Material and Equipment on the Duluth, Missabe & Iron Range 2-8-8-4 Locomotives

Locomotive bed; engine and trailer-truck frame	General Steel Castings Corp., Eddy-stone, Pa.	Low-water alarm; flexible joint in blow-off cock piping; drain valve; lubricator steam-heat joint	Barco Manufacturing Co., Chicago
Boiler and firebox steel; front bumper plate; tank plates	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.	Feedwater heater	(5) The Superheater Company, New York
Grates	Waugh Equipment Co., New York		(5) Worthington Pump and Machinery Company, Harrison, N. J.
Fire brick	American Arch Co., Inc., New York	Stoker; coal pusher	Standard Stoker Co., Inc., New York
Washout plugs; boiler plugs; sand-box plugs	Huron Mfg. Co., Detroit, Mich.	Blow-off cocks and mufflers; operating valves; radiator elements; air compressors	Wilson Engineering Corp., Chicago
Crown drop plugs	Nathan Manufacturing Co., New York	Safety valves	Coale Muffler & Safety Valve Co., Baltimore, Md.
Boiler lagging; smokebox door gaskets; cylinder lagging	Johns-Manville Sales Corp., New York	Water gage	Talmadge Mfg. Co., Cleveland, Ohio
Flue blower	Superior Railway Products Corp., Pittsburgh, Pa.	Gage cocks; inspection card holders	The Prime Manufacturing Co., Milwaukee, Wis.
Staybolt iron	Ewald Iron Co., Louisville, Ky.	Bell ringer	Railway Service & Supply Corp., Indianapolis, Ind.
	Lockhart Iron & Steel Co., McKees Rocks, Pa.	Gages—air, back pressure and steam	Ashton Valve Co., Boston, Mass.
	Ulater Iron Works, Dover, N. J.	Steam pipe joint packing; exhaust pipe joint packing	The Swanson Company, Chicago
Flexible staybolts	Flannery Bolt Co., Bridgeville, Pa.		The Garlock Packing Company, Palmyra, New York
Syphons	Locomotive Firebox Co., Chicago	Whistle; operating valve and check; rail washer	Viloco Railway Equipment Co., Chicago
Front-end throttle	American Throttle Co., New York		
Throttle-valve-stem packing	The Garlock Packing Company, Palmyra, New York	Runboards; grating and runboard steps; front deck and cab deck	Irving Iron Works Co., Long Island City, New York
Dry pipe; boiler tubes and flues; arch tubes	National Tube Co., Pittsburgh, Pa.	Waist sheet bearer pad; boiler support pad; spring end pads; back trailer hanger pads	Fabreeka Products Co., Boston, Mass.
Superheater; pyrometer	The Superheater Company, New York	Draft gear; draft gear yokes—engine and tender	W. H. Miner, Inc., Chicago
Injectors; injector steam valve; coal sprinkler	Wm. Sellers & Co., Inc., Philadelphia, Pa.	Coupler; pilot; pilot coupler pocket; driving springs; engine truck springs; trailer springs	American Steel Foundries, Chicago
Injector check valve	Manning, Maxwell & Moore, Inc., Bridgeport, Conn.		

The arrangement of the front end showing the mounting of the air compressors, the mechanical lubricators and the arrangement of motion work



Cylinder bushings; piston valve bushings; pistons; piston valves; cylinder packing rings and piston valve packing rings	Hunt-Spiller Manufacturing Corporation, Boston, Mass.
Cylinder-by-pass valves	Viloco Railway Equipment Co., Chicago
Cylinder cocks and operating valves	T-Z Railway Equipment Co., Chicago
Roller bearings, driving	The Timken Roller Bearing Co., Canton, Ohio
Roller bearings—engine and trailer; clasp brakes	American Steel Foundries, Chicago
Axles, engine-truck wheels	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Tires, driving and trailing	American Locomotive Co., Railway Steel Spring Div., New York
Trailer wheels	Standard Steel Works Division of the Baldwin Locomotive Works, Eddystone, Pa.
Driving wheel centers	General Steel Castings Corp., Eddystone, Pa.
Brake shoes	American Brake Shoe Company, New York
Foundation brake	American Brake Div., Westinghouse Air Brake Co., Wilmerding, Pa.
Brake equipment	Westinghouse Air Brake Co., Wilmerding, Pa.
Crossheads; wrist pins; guides	Standard Steel Works Division of the Baldwin Locomotive Works, Eddystone, Pa.
Crosshead shoes; eccentric rod brasses; main and side rod bushings	National Bearing Metals Corp., St. Louis, Mo.
Piston-rod and valve-stem packing	Paxton-Mitchell Co., Omaha, Neb.
Valve gear	Pilliod Co., New York
Reverse gear	Baldwin Locomotive Works, Inc., Philadelphia, Pa.
Reverse-gear packing	Johns-Manville Sales Corp., New York
Reverse-gear valve	Railway Service & Supply Corp., Indianapolis, Ind.
Lubricator oil pipe covering; lubricator steam pipe covering; steam pipe covering	Union Asbestos & Rubber Co., Chicago
Air-compressor lubricator	U. S. Metallic Packing Co., Philadelphia, Pa.
Firedoor; radial buffer; automatic compensator and snubber; bronze floating plates on all driving boxes	Franklin Railway Supply Co., Inc., New York
Mechanical lubricators; lubricator distributors; oil and terminal checks; flange oiler; lubricator tube fittings	Nathan Manufacturing Co., New York
Lubricator tubing (steel)	Bundy Tubing Co., Detroit, Mich.
Grease fittings	Alemite Div., Stewart-Warner Corp., Chicago
Locomotive valves	Crane Co., Chicago
Marker lamps	The Adams & Westlake Co., Elkhart, Ind.
Headlights and generator	The Pyle-National Company, Chicago
Sanders; traps; operating valves	Graham-White Sander Corp., Roanoke, Va.
Valve Pilot; speed recorder	Valve Pilot Corporation, New York
Air-pump lubricator checks	Bonney Forge & Tool Works, Allentown, Pa.
Cab apron	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Cab seats	Gustin-Bacon Mfg. Co., Kansas City, Mo.
Cab-door weatherstripping	Bridgeport Fabrics, Inc., Bridgeport, Conn.
Cab insulation	Johns-Manville Sales Corp., New York

Cab ventilator; windshields; clear vision windows; curtains	The Prime Manufacturing Co., Milwaukee, Wis.
Cab lamps	The Pyle-National Company, Chicago
Tender: Frame; trucks	General Steel Castings Corp., Eddystone, Pa.
Wheels and axles	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Coupler; springs	American Steel Foundries, Chicago
Journal bearings	American Steel Foundries, Chicago
Brake shoes	Magnus Metal Corporation, New York
Trailer box lids; truck boxes; truck-box lids	American Brake Shoe Company, New York
Truck box pads	National Malleable & Steel Castings Co., Cleveland, Ohio
Safety bars and drawbar	Fabreeka Products Co., Boston, Mass.
Tank hose	Standard Steel Works Division of the Baldwin Locomotive Works, Eddystone, Pa.
Tank valves; drain plugs; couplers and strainers; hose couplings	United States Rubber Co., New York
Tank water level indicator	T-Z Railway Equipment Co., Chicago
Sleeve joints between engine and tender	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
	Franklin Railway Supply Co., Inc., New York

E 6-in. by 8-in. couplers with Simplex pockets, Miner A-78-XB draft gear, Franklin E-2 radial buffer, Pyle-National headlight and cab lamps, and Graham-White sanders, traps and operating valves.

The Tender

The tenders are the rectangular-U type with a fuel and water capacity of 26 tons and 25,000 gal. The under-frame and trucks were supplied by the General Steel Castings Corporation. The tender* is carried at the front by a four-wheel truck back of which are five pairs of wheels mounted in pedestals cast integral with the bed. The 42-in. tender wheels operate in A. S. F. roller-bearing assemblies with auxiliary bearings.

The coal space is equipped with a Standard type DA coal pusher. Franklin flexible joints are used on the air-brake lines, and stoker and coal-pusher steam lines between engine and tender.

The tender draft gear is Miner A-78-XB and the couplers are A. S. F. Type E.

The tender trucks are equipped with A. S. F. clasp brakes designed for operation on 18-deg. curves, operated by 8-in. by 10-in. cylinders and having a braking ratio of 70 per cent at 50-lb. cylinder pressure.

* For a description of this type of tender frame see the *Railway Mechanical Engineer* for October, 1940, page 386.

Employs Many Women Workers

A ROUGH survey of the mechanical department manpower situation indicates that while some railroads have gone to unusual lengths in recruiting women workers to replace men who have gone into the armed services, or who have been attracted to the war industries, other important railroads have added few, if any, women to their forces, except perhaps in those limited occupations in which women were employed in normal times.

It is not surprising to find that systems like the Pennsylvania, in a highly industrialized area, or the Southern Pacific, serving the West Coast region, in which great war industries have sprung up almost overnight, have introduced an unusually large number of women into jobs not normally performed by them. It is just as surprising, however, to find some systems serving industrial or agricultural sections that have added few, if any, women to their forces, except to replace men in clerical positions, which were normally open to women as well.

Before the entry of this country into the war, the Pennsylvania System employed only about 1,300 women. Today the number is in the neighborhood of 20,000. Approximately 1,500 of these are helpers to blacksmiths, boilermakers, carmen, electricians, machinists, tinsmiths, tender repairmen, upholsterers and cranemen. Two women operate hammers in the blacksmith shop; there are 20 women boiler washers; more than 300 women oilers, and about 700 women locomotive cleaners and preparers. There are now more than 2,000 women coach cleaners, of whom a number have become gang foremen.

As of May 5, the mechanical department of the Illinois Central employed 758 women. Of these, 231 were in the locomotive department. In addition to 43 clerks, there were 6 electrical helpers, 2 machinist helpers, 2 engine washers, 13 water testers and 165 laborers. Of the 527 women employees in the car department, only 15 were clerks; the others included 3 upholsterers, 10 carman helpers, 1 wheel roller, 199 cleaners, 13 car oilers, 4 caboose supply, and 38 laborers.

As of June 1, about 12,060 employees of the Southern Pacific had been called into service. As of that date, approximately 3,000 women were employed in the motive power and car departments, stores department and maintenance of way department. Recognizing that the introduction of a large number of women into departments in which previously only men had been employed, and at jobs which in many instances required heavy physical effort, involved unusual and highly specialized problems if the most efficient results were to be secured, the Southern Pacific mechanical department appointed a supervisor of women employees in each of its two districts, North and South.

"New Grooms For the Iron Horse"

The Pacific Railway Club, always keen to keep its programs abreast of the times, announced as the subject of its May meeting, "New Grooms for the Iron Horse." The speakers were Mrs. M. J. Warren, supervisor of women employees, mechanical department, Southern Pacific Company, Northern District; and Mrs. R. L. Tib-

Demands of the armed services and competition of war industries force railroads to go to unusual lengths in the effort to solve the manpower problem

(Illustrations on pages 327, 333 and 340)

bett, supervisor of women employees, mechanical department, Southern Pacific Company, Southern District. They must have made a distinct impression upon the club members, since its board of governors decided thereafter to admit women to membership in the club on the same qualifications as men. This was "because of the splendid showing that women are making in the war effort, particularly in supervisory positions."

Extracts from the talks given by Mrs. Warren and Mrs. Tibbett follow:

Women Workers on Southern Pacific

By Marjorie J. Warren*

Every day we hear of the WAACS, the WAVES and the SPARS, who have a place on the front pages of our newspapers, and who are without doubt playing a great part in the United Nations' war effort, relieving men for active duty at the front. Unsung and unheralded is that noble group of women who are taking the places of men on our transportation systems today, so these men may fill the ranks of our fighting units.

Women have long been employed in some industries and their places there are taken for granted; their work has been satisfactory in every way. In the railroad industry it was different. Some departments were considered as man's domain and women were not welcomed; in fact, were denied the privilege of proving their ability to do the work involved. As men became scarcer, the women were given a chance at some of the heavier work and on some of the machines.

In our railroad shops the placing of women has been gradual. First as laborers, to helpers, and so on to other work. Now there is a demand for women and we are encouraging women to study and fit themselves for the various branches of railroad shop work; to fit themselves for advanced work and to be ready to step in when the opportunity affords.

PERSONALITY PROBLEMS

In placing women in railroad work, there are a number of personality qualities to consider, which cannot be

* Mrs. Marjorie Jane Warren, a former school teacher and practical nurse, gave up her nursing practice in September, 1942, to become a laborer in the Sacramento, Calif., shops of the Southern Pacific. A month later she was made toolroom attendant in the pipe shop and was given the title of pipefitter's helper. On January 16, 1943, she was promoted to the newly created position of supervisor of women.

overlooked. They have to be dealt with and this must be done with tact and understanding. I shall list and deal with these as follows:

1. As women are inclined to be more sociable than men, and as this trait is more pronounced in some women than in others, we must look for some visiting between employees during working hours, and deal with the problem in a nice way. Otherwise we would create a bad feeling which must be avoided.

2. Again, women are inclined to be less aggressive than men and this is only natural. In her long years of keeping up her home, rearing her children and caring for her husband's comfort and welfare, woman, in the security of her home, has had no reason to put herself forward in an aggressive manner.

3. Women are inclined to be more sensitive to criticism than men, and this is a hard problem to deal with. Her nervous system being so vastly different from man, it is but natural that she is more sensitive to any criticism of her work, no matter how trivial. They strive to do their work well and are eager to learn, and if criticized they take it to heart.

4. Women are inclined to take things that happen in their work quite personally, and this becomes a problem to deal with, but we are doing a nice job of overcoming this.

5. Women are more sensitive to discomforts than most men. Women have always strived to be comfortable no matter what their surroundings, and we have but to look into their homes to note the many little comforts they provide, so it is natural that such things as dust, dirt and drafts are irritating. As they become more accustomed to their work and surroundings, these irritating discomforts will be less noticed.

6. Women are inclined to be more interested in the activities and conduct of others. In other words, they take more notice and interest in those that work with them, so—

7. We find that pleasant associations with other workers are an important factor in inducing the women to like their work.

8. More petty quarrels and disputes occur among women than among men, and we find that some women feel they have occasion to feel slighted if they are of the opinion that some other woman is given a little better place, and they want to dispute her right to that place. This is taken care of nicely if one uses a little tact in settling the disputes.

A desire for praise is very strong among women, and a little word here, a pat on the back there, and a smile to go with it, will do a world of good and accomplish a great deal.

POSITIONS FILLED BY WOMEN

Among the many and varied positions now being filled by our women employees I might list the following:

Running drill presses, bolt and nut threaders, operating steam hammers, stationary firewomen, fire lighters, blacksmith helpers, cleaning and servicing batteries, assisting painters, machinist helpers, oiling and packing journal boxes on freight cars, delivery clerks on trucks, sorting and assembling material, making boxes, babbitt journal bearings, removing babbitt from worn-out bearings, running broaching machines on car bearings, sorting scrap, etc. They have now been assigned as helpers to nearly every craft in the shops, and in the stores department have taken over all but the very heaviest work.

Women Workers in Southern District

By Ruth L. Tibbet*

A few years ago it would have been practically impossible for us to visualize a woman with her gay bandanna, or jaunty cap, attractive make-up and overalls, busily operating a steam hammer, running a crane, a drill press, or a bolt machine. My southern district includes Bayshore and San Francisco, south to Yuma. I have approximately 1,700 women, about 550 of whom are in the Los Angeles area, 250 at Bayshore, with women in San Francisco, San Luis Obispo, Bakersfield, Mojave, Colton and Indio.

In addition to the work mentioned, we have a large number of laborers who keep our shops and grounds clean; also helpers in machine, paint, electric, pipe, boiler, blacksmith and car shops. According to a recent memorandum of agreement, it is possible for a helper with 60 days seniority to bid on a helper apprenticeship. Some of our women are very interested in doing this.

Besides shop work, we have the all-important job of keeping our engines serviced. We use girls in the roundhouse as oilers, grease cup fillers, supply women, cellar packers, fire lighters and watchers. Girls also keep the roundhouse clean, wash engines and clean the cabs.

In the coach yard the girls clean all of our cars inside and out, and despite the speed with which they come and go, the women keep them cleaner than they have ever been before.

The general foremen in our shop have charge of placing the women in the department where they are most needed. The women bid on helpers' jobs the same as men. However, we have encouraged the practice of setting up laborers to helpers according to their length of service with the company. We have women of all ages from 18 to 60, and all types and all nationalities.

COMPANY'S OBLIGATIONS TO WOMEN

I have told you in a general way what women are doing for us. Now—what are we doing for women? We have, first, endeavored to make our work as interesting and profitable to women as possible. We have made our rest rooms comfortable and complete by providing dressing and locker rooms, lunch room and showers. In my capacity as counselor, I have obtained information for our women concerning housing, day nursery care, a list of available afternoon playgrounds, family problem clinics and health clinics.

We are encouraging our girls to take advantage of the helper apprenticeships and are encouraging them to study. We are carrying on a survey in our shops to see in how many jobs in each department we can use women. A program is under way to acquaint supervisors with the necessity of bringing women into our shops. We are helping them to study the problems arising from the employment of women, such as their differences in temperament, their sensitiveness to favoritism, and their slower grasp of mechanics. With proper planning, women can be used in every department of the railroad. The manpower shortage is so acute that our women employees are becoming doubly valuable. We have safety men and
(Continued on page 312)

* Mrs. Ruth L. Tibbet comes of a railroad family. Her father is J. E. Lingenfelter, a draftsman at the Los Angeles shops, who was at one time supervisor of apprentices at El Paso. Mrs. Tibbet is a former professional accompanist in radio and concert work, practical nurse, drama coach and public school teacher. She entered the service of the Southern Pacific in July, 1942, as a general clerk in the office of the superintendent of motive power at Los Angeles, and was working as a timekeeper when promoted to her present position on February 1 of this year.

Steam Distribution*

Part II

By Walter Smith†

Difficulty of Obtaining Effective Steam Distribution

AUTHORITIES agree that an ideal valve and valve-gear arrangement would give (a) infinite variability of cut-off, (b) full valve opening at all cut-offs, (c) rapid opening and closing of the valves, and (d) control of the timing of admission, release, and compression, independent of the cut-off. The piston valve and our present radial valve gears fall short of these requisites. Obviously, the principal shortcomings of the present arrangements are the fixed relationships between the valve events, and, most important of all, the difficulty of obtaining suitable steam port openings at short cut-offs. The fact deserves notice in this connection that one of the inherent characteristics of our present radial valve gears is that the short cut-off port opening is only the lead plus a small increment depending upon the ratio of lap and lead to valve travel. A moment's consideration will show that this is sure to restrict the steam volume passed by the valves at high speed. It is not easy to visualize the rapidity with which the valve events take place at high speed.

For example, at diameter speed—336 revolutions per minute—the interval of time for admission at 25 per cent cut-off is approximately one-fortieth of a second.

Considering the fact that the port opening is small and the time interval for admission short, it is not surprising that the steam pressure drops rapidly between the point of admission and cut-off. Wire drawing is concerned here also. As the piston moves away from the cylinder head the flow of steam is not sufficient to keep up with the increasing volume of cylinder and what is known as initial expansion is present from the beginning of the stroke.

Obtaining More Effective Steam Distribution

The object desired is to secure ratios and proportions that will give more adequate port areas, and thus insure a higher mean effective pressure at high speed. Steam-port opening areas at any particular cut-off can only be increased by (1) increasing the diameter of the valve, (2) widening the steam lap, and (3) increasing the lead. In view of the fact that it is impracticable to use valves larger than 14 in., and lead in excess of $\frac{5}{16}$ in., it appears that the only alternative is to extend the steam lap. These facts are recognized, and the trend is toward consideration of wider steam lap. Here it may be of interest to point out the main facts concerning this important detail.

EXTENDED STEAM LAP

Theoretically, there is considerable to be gained by widening out the steam lap. In most every respect the

* A paper presented before the Northwest Locomotive Association at St. Paul, Minn., on April 19, 1943. Part I appeared in the June issue.
† Western manager, Pilliod Company.

Characteristics of piston valves and conventional valve gears—Their strong points and shortcomings and how best results may be obtained with them

advantages are outstanding. When the lap is extended the following desirable features are obtained:

1—Wider port openings for both admission and exhaust, particularly in shorter cut-offs.

2—Increased valve travel for a given point of cut-off resulting in greater valve velocity and quicker full port opening with a longer duration of the maximum port opening.

3—More accurate timing of valve events, and steam volumes to and from the cylinder more positively governed.

4—Decreased influence from lost motion and faulty adjustments of valve gear.

5—Less pre-admission for a given lead at all points of cut-off.

6—Full and free pre-release, resulting in a lower back pressure.

7—Better control of compression.

8—Higher mean effective pressure at all points of cut-off.

Offsetting these advantages to a slight extent is the fact that the increase in lap shortens the full-gear cut-off, unless provision is made for longer valve travel.

Let us consider now a less effective means of getting more adequate port openings.

PISTON VALVES OF LIBERAL DIAMETER

Although it is possible to get considerably greater port opening areas by increasing the diameter of piston valves, it seems to be generally conceded that valves of 14 in. or 15 in. in diameter are to be considered the maximum desirable from a construction and operating standpoint. Within these limits, the larger the valve the more effective the steam distribution in consequence of the reduced throttling or wire-drawing effect. But with the larger valves it is necessary to accept greater weight, increased clearance volume, and greater frictional and inertia forces. It has been determined by experiment that the stresses in valve rods and valve gear increase with the speed, cut-off, and weight of valves. Granting that there is some gain in inertia effect by use of a smaller valve, the fact remains that this is offset to a large extent by the longer cut-off and greater valve displacement required for the same power output.

No one will question the desirability of using the

smallest and lightest valves consistent with other considerations. However, it must be borne in mind that restricted valve openings distinctly and definitely limit the horsepower capacity of high-speed locomotives. Consequently, there is good reason for questioning the wisdom of reducing valve sizes below those now considered permissible. In spite of all the arguments that can be offered in justification of smaller valves, there are very compelling reasons for using valves of liberal diameter. It is manifestly impossible to develop high cylinder horsepower on a fine thread of steam, and that is what happens when a small-valve locomotive is operated at short cut-offs. It has been aptly stated that the most noticeable characteristic of small-valve locomotives is the longer cut-off required, and the higher back pressure developed for a given power output.

Obviously, the logical thing to do is to take full advantage of weight-saving construction in valves of liberal diameter, and then provide a valve gear to meet the stresses. There is evidence to indicate that the vogue for small piston valves is passing. Lastly, it should be pointed out that it is vitally necessary that the area of the cylinder port should be sufficient to take care at the end of the stroke of the exhaust-opening area provided by the valve. Otherwise, it is ineffectual to provide valves of liberal diameter.

Distribution Valves

ADVANTAGES AND DISADVANTAGES OF PISTON VALVES

The piston valve is peculiarly adapted to modern locomotive service. It has served the need of a dependable device for distributing steam to locomotive cylinders for forty years; and there is nothing at present to indicate that it will be superseded. The fact that it does not require precision workmanship and that it is dependable to an unusual degree have made it almost an indispensable part of modern locomotive design. That it has shortcomings no one will deny. Principal among these are frictional resistance from sliding surfaces, inability to relieve excess pressure in the cylinder port, imperfect ring balance, the fixed relationship between the valve events, and inertia effect from unbalanced weight.

DESIGN OF PISTON VALVES

In the design of piston valves weight is of primary importance. Until recently full advantage was not taken of the possibilities for weight saving. A not inconsiderable saving in weight may be effected by welding flanged ends to a pipe for spool construction. An area through the spool equal to about half the area of exhaust nozzle orifice is sufficient to obviate the hammering of the exhaust steam on the valve ends. Hence a spool constructed of 6-in. pipe or tubing will suffice in most cases. Preferably, the flanged ends of spool should have an angle of 45 deg. instead of 90 deg. There is a possibility that the latter will distort when the valve is tightened up. When advantage is taken of the full possibilities of reducing the weight of spool, bull-rings, and followers, the weight of valve stem can also be reduced, and to insure a high safety factor the improved physical properties of alloy steel can be utilized for strength and weight saving.

PISTON-VALVE DETAILS

It has been proposed to modify the design of packing rings. The object in view is to improve packing rings by locking and putting them in perfect steam balance, preventing exhaust rings from collapsing under compression, or being forced from grooves into ports between bridges, and stopping leakage of live steam to the ex-

haust side of the valve. These are attractive advantages but very difficult of accomplishment. It appears that the laws governing the pressure balancing of rings are imperfectly understood, and efforts made in the past to improve this feature were not crowned with success. Sectional packing rings of bronze or cast iron, or both combined, seem to give some advantage when carefully installed.

VALVE BUSHINGS

There has been a growing tendency to use more and wider bridges in valve bushings. This has been especially noticeable since the introduction of sectional packing rings. From the standpoint of steam efficiency this practice is very objectionable, as it still further restricts the port area.

If the width of the port is proportioned to the sum of steam lap, lead, and exhaust clearance, it will take care of the exhaust opening at the end of the piston stroke, which is sufficient to take care of all requirements. Since the passing of continuous bushings, holding the split bushings to the specified distance between ports has become a problem. In order to back up the keeper plugs against partial or momentary seizure between the valve and the bushing, valve bushings should be provided with two or three lugs which extend to the joint on the valve-chest heads.

MAINTENANCE OF PISTON VALVES

The importance of properly maintaining piston valves cannot be over estimated. Besides the loss from leakage when considered from the viewpoint of steam economy or operating efficiency, steam leakage past the rings need not be very noticeable to cause an appreciable loss of power. Leaky valve rings are not only wasteful of steam but they make adequate valve and cylinder lubrication difficult of accomplishment. As a result frictional resistance is greatly increased, resulting in greater load on the valve gear, and loss in horsepower output of the locomotive. Here, as elsewhere, precision workmanship is the cheapest in the long run. When valve chambers are accurately bored with a smooth finish, and rings finished turned to the exact bore of bushings, steam leakage becomes almost nil, and lubrication is greatly facilitated. This means effective service at low cost on a mileage basis.

By far the best method of boring valve chambers is by means of a 12- or 14-cutter reamer. This can be used in connection with the standard portable boring bar by replacing the usual two-tool head with a special multiple-cutter head. It has the overwhelming advantage of giving a very smooth and accurate job in about half the time ordinarily consumed. The best fitting packing rings are turned to the old piston ring rule: from $\frac{3}{32}$ to $\frac{3}{16}$ in. larger than the bore, according to the size of the valve; then from $\frac{3}{16}$ in. to $\frac{1}{2}$ in. cut out, the ring clamped in a jig and turned to the exact size of the cage.

Conventional Radial Valve Gears

WALSCHAERT AND BAKER VALVE GEARS

A study of modern high-speed locomotives indicates that there are only two valve gears, which are used to actuate piston valves. These are the Walschaert and Baker gears. Characteristically, they are much the same; both derive their motion from eccentric cranks and combination levers. However, the Baker gear with its pivoted members replacing the oscillating link of the Walschaert mechanism has capacity for greater travel. Both of these valve gears have demonstrated their ability

to meet all of the requirements of the most exacting service. From the standpoint of reliability in service, simplicity in operation, and ease of maintenance, these gears leave little to be desired. In fact, they are marvelously well adapted to modern locomotive service. The outstanding advantages are (1) low first cost, (2) low maintenance cost, (3) reliability in service, and (4) ability to hold adjustment. However, in order to insure these desirable characteristics the design must be such that all parts have the requisite strength and stiffness, with bearings of ample size, and all pins arranged for double shear.

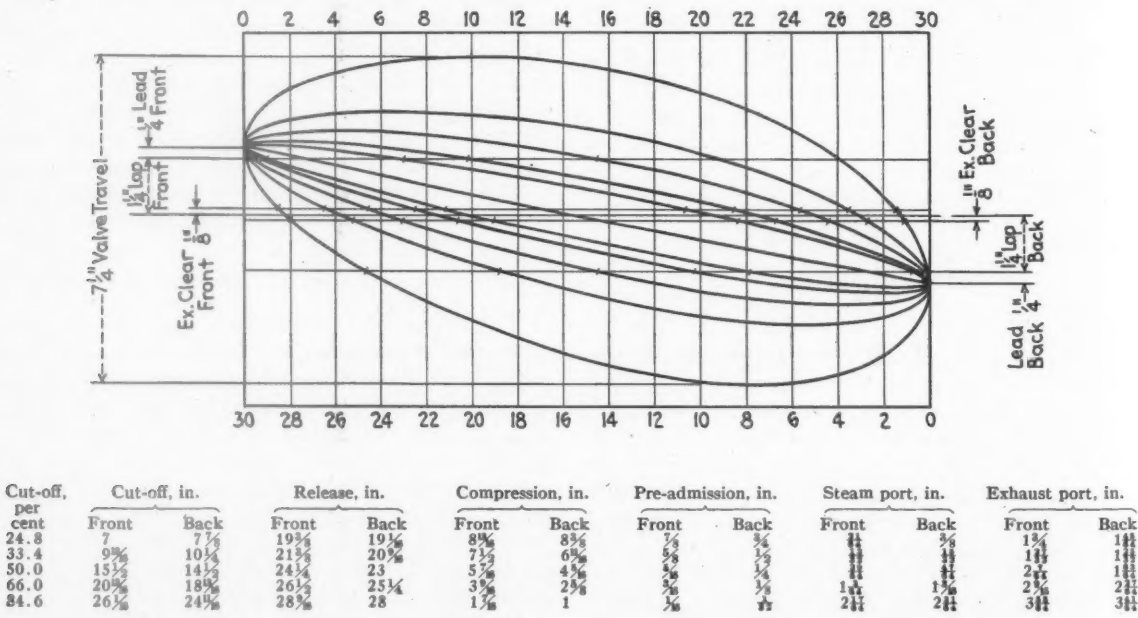
SERVICE REQUIREMENTS

Valve gears in present-day locomotive service are subjected to severe and complex operating stresses which

proving the steam distribution. As a result progress has been made along the lines of lower maintenance costs and greater reliability in service.

The weight of the valve-gear parts themselves is an important factor, and the trend is toward light-weight gears employing special steels of high strength properties. Precision of movement is dependent upon stiffness of the parts, and the absence of lost motion in the bearings. Parts should be proportioned so that they have the maximum strength with minimum weight.

Most important of all, bearings should be arranged with double-shear pins. It has been demonstrated beyond question that single-shear pins will not stand up under present service requirements. The designer must take every precaution to preclude vibration and distortion of parts. In view of this, it may be advisable to



Characteristic valve events attainable with Walschaert valve gear

are difficult to analyze. The duties which they have to perform are exacting in the extreme. Higher speeds and more intense utilization of locomotives has made service requirements more severe, and increased the hazard of engine failures. What is required is a valve gear with demonstrated reliability, and which will stay square from shopping to shopping with a minimum of up-keep. Both the Baker and Walschaert gears have shown their ability to do this. It should be repeated that stresses in valve gears increase with the speed, cut-off, and weight of valves; also that the inertia forces in the valve gear vary as the square of the speed.

DESIGN AND CONSTRUCTION

Because of the extremely severe service to which valve gears are subjected in modern high-speed service, the utmost care must be taken in their design. Various efforts have been directed toward improving their movement, but none of these have met with success for the reason that too much complication is involved. Nevertheless, the urge to produce new valve-gear attachments continues and, as might be expected, few of these get farther than the drawing board.

In view of this the emphasis has been upon refining the design, eliminating proved points of weakness, and stiffening the actuating mechanism, rather than upon im-

proving the steam distribution. As a result progress has been made along the lines of lower maintenance costs and greater reliability in service.

Equally important with the preceding consideration is the matter of crank throw. Due to the whipping action of the eccentric crank and of the back-end of the eccentric rod at high speed, it is desirable and necessary to limit the eccentric-crank throw so that the crank circle does not exceed 21 in. In the case of the Walschaert valve gear this means that the link swing must not be more than 45 deg. with a long link used as a compensating factor. With respect to the Baker gear, the gear connecting rod must be shortened to 16 in. All this results in small working angles, giving an easy and smooth working valve motion.

CHARACTERISTIC OF PRESENT RADIAL VALVE GEARS

The Baker and Walschaert valve gears do not give everything that is to be desired in the way of port opening at short cut-off, but they give a reliability that is not to be expected of other arrangements. The fact that the port opening becomes progressively smaller as the cut-off is shortened is undeniably an undesirable characteristic. But, as has been shown, it is not as serious a defect since the introduction of smaller cylinders and highly vitalized steam. Various notable attempts have been made during the past to improve steam distribution by introducing

valve mechanisms which give quicker valve movement and less port restriction, but none of these have survived. It is well known that the conventional piston valve actuated by our present valve gears imposes certain restrictions on power output at speeds. But a slight sacrifice in power is preferable to operating and maintenance difficulties.

Finally, with reference to valve events, what is most desired is uniformity. This is a function of the characteristics of the valve gear as affected by design. The Baker valve gear is very satisfactory in this respect even when long valve travel is required. With reference to the Walschaert valve gear, it can be said that within its limitations of travel this gear can be designed to give sufficiently uniform valve events. But when the travel is extended beyond 7½ in. there is considerable irregularity.

MULTIROL NEEDLE BEARINGS

Among the outstanding developments and tendencies in valve-gear construction is the trend toward anti-friction bearings at all pin connections. These needle bearings have great load-carrying capacity in proportion to their size. They are a self-contained unit with a series of small rollers or needles running between inner and outer races, which are held in place by heavy snap rings on each side of the bearing. Because of their small over-

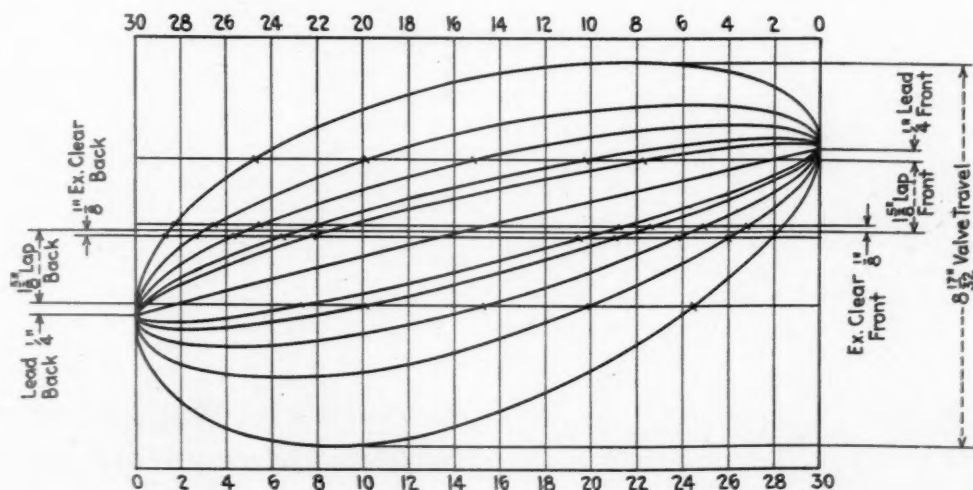
they require very little lubrication and will run from 1,500 to 2,000 miles between lubrication periods.

An interesting sidelight bearing upon this subject is the experience gained on one railroad by substituting roller bearings for Walschaert valve-gear link blocks. As the link block is a critical point in the Walschaert gear, at the outset this seemed like a rather hazardous undertaking. But in view of several years of successful operation on about 25 high-powered locomotives the practice seems to be justified.

VALVE SETTING

The art of valve setting resolves itself into getting the best possible steam distribution from a given design and arrangement of valves and valve gear. Any discussion of valve setting invariably brings out conflict of opinion on the relative merits of the various methods used. It still remains true that the desired objective is to obtain good equalization of power. So long as this is attained the precise method used is not so important.

Lead itself does not vitally affect steam distribution but equalization of the lead is important because in a well designed gear this is the best means of insuring approximate uniformity of the other valve events. Hence, it appears logical that lead should be the basis of valve setting. In consequence of the foregoing, we recommend that the port openings and cut-offs in the running position should be equalized after a preliminary adjustment



Cut-off, per cent	Cut-off, in.		Release, in.		Compression, in.		Pre-admission, in.		Steam port, in.		Exhaust port, in.		Yoke position, in.
	Front	Back	Front	Back	Front	Back	Front	Back	Front	Back	Front	Back	
25.3	7%	7%	20%	19%	8%	7%	3%	3%	2%	2%	2%	2%	14%
33.7	10%	10%	22%	21%	7%	6%	3%	3%	2%	2%	2%	2%	13%
50.5	15%	15%	24%	23%	5%	4%	3%	3%	1%	1%	3%	2%	12%
66.2	19%	19%	26%	25%	3%	2%	3%	3%	1%	1%	3%	2%	11%
81.9	24%	24%	28%	27%	1%	1%	3%	3%	2%	2%	4%	3%	9%

Valve events obtained with the long lap valve and Baker gear

all size, they are in some cases interchangeable with existing bronze bushings. Bearings are completely enclosed, which keeps out dirt and grit and makes lubrication simple.

The application of needle bearings eliminates the play inherent in friction bearings and thus greatly reduces the shock load on the valve gear. There is the further advantage that at high speeds the distortion in valve events due to whip is eliminated. A particular virtue of needle bearings is their ability to maintain effective steam distribution for long periods without maintenance cost. The fact deserves notice in this connection that

of the lead. Regarding the long cut-offs, which are only used for starting and slow speeds, it should be noted that square port openings are not essential to good distribution of power provided the cut-offs are fairly well equalized. At the short cut-offs, however, which are used at high speeds, close equalization of the port openings is as important as equalization of the cut-offs.

Elliptical Valve Diagrams

Unquestionably, the best method of determining valve-gear characteristics is by means of a full-size valve model to which an ellipsometer has been attached. The ellipso-

meter is a device which records graphically the precise movement of the valve correlated to that of the piston. This oval or elliptical diagram affords a very simple and convenient means of analyzing valve movement and valve events. It gives a graphic picture of what takes place. Piston stroke is represented by its length and valve travel by its width. As usually arranged, its length is proportional to one-half of its width. If reduced in size these relative proportions are maintained. There is no better basis of comparison of different valve arrangements than the valve ellipse affords.

Some insight as to the effect of valve and valve-gear details and proportions upon valve events and valve movement can be had by comparing the accompanying ellipses. The first is an ellipse from a Walschaert valve gear with moderate valve travel and conservatively selected valve details. Next is an ellipse from a Baker gear with long valve travel and fairly wide steam lap. Even a superficial examination will quickly disclose the advantage derived from the latter arrangement. It strikingly illustrates the merits of long valve travel and wide steam lap.

Valve events and valve movement can be checked on a drawing board by laying the gear down and checking the kinematic movement. This is a laborious procedure, and not altogether satisfactory. A complete valve record taken from an actual locomotive provides an accurate means of checking valve events, and is useful in determining valve-gear characteristics, but is slow and costly.

Cut-Off the Chief Factor in Locomotive Operation

VALVE PILOT

Observations of students and engineers based on dynamometer-car and testing-plant data abundantly prove the contention that there is a cut-off which for every speed will give maximum power and economy. The Valve Pilot functions on this definite relationship between speed and cut-off. Briefly, it combines a speed recording device with a cut-off indicator and recorder, which is actuated by the reverse shaft of the locomotive through a cam mechanism. In this connection, it is of interest to note that the cam is designed after a careful check of valve gear characteristics, and other pertinent data. By thus synchronizing speed and cut-off the Valve Pilot standardizes the variable man factor in locomotive operation. As can readily be observed, it is not an automatic controller. The control still remains in the hands of the engineman, where it properly belongs, but it invariably indicates the correct method of operation, which if followed will give maximum power and speed.

SHORT CUT-OFF OPERATION

It has already been shown that it is usually ineffective to attempt to get greater power output at speed by lengthening the cut-off. On the other hand, as speed increases the cut-off must be shortened; the higher the speed (revolutions per minute) the shorter must be the cut-off for maximum power. This is a matter of inlet and outlet valve port-area ratio, which varies with the cut-off, increasing as the cut-off is shortened. Shorter cut-offs at high speed tend to offset the increase in back pressure brought about by the higher piston speed. However, it must be recognized in this connection that the conventional arrangement of piston valve and radial valve gear is critical in this respect, and unless unusual refinement has been used in fixing the details, cut-offs shorter than 25 per cent are not practical, in spite of the fact that higher steam pressure, more lead, a larger valve, or a larger cylinder make it possible to work at a shorter cut-

off. It is a matter of the disturbing effect of higher negative forces.

POWER REVERSE GEARS

Viewed from the standpoint of effective valve-gear performance the power reverse gear is an adjunct of vital importance. It must hold the valve gear at the desired cut-off without creeping or shimmying, and it must give fine adjustment. These requirements are difficult to meet, and reverse-gear trouble is all too frequent. It is hard to escape the conclusion that in most cases maintenance is at fault.

A simple means of insuring more dependable operation from power reverse gears is to replace the usual reverse-shaft bearings with J. M. friction bushings. The material used in these bushings is somewhat similar to brake lining, and it sets up an initial resistance which is helpful in overcoming the sensitiveness of troublesome reverse gears.

Conclusions

From the foregoing considerations it seems reasonable to conclude that if the full power potentialities of the locomotive are desired and necessary the port areas must be liberal. This means that the valves must be of sufficient diameter, and arranged for wide steam lap. Furthermore, in order to insure free steam flow through the passages these should be of ample area and streamlined. And, finally, nothing is more important than a properly designed boiler which delivers steam of high quality, and in sufficient volume to meet all requirements, without requiring excess back pressure for draft. Otherwise the most efficient valve and valve gear arrangement will be ineffective.

In conclusion, let it be said that the limit of effectiveness at high speed is the ability to pass steam in sufficient volume to maintain the mean effective pressure. It should be clear by now that the important factors in steam action are mean effective pressure and steam consumption.

Mechanical Department Employs Many Women Workers

(Continued from page 307)

women constantly on the job to impress on the minds of our women that there is a right way to do everything.

In handling women's problems there are so many seemingly unrelated things to be taken care of, in order to keep the trains rolling. The human interest angle is endless. The loss of a baby, that difficult time when son, sweetheart, husband or brother is sent across, are times when we need to have double consideration and understanding. Or we have a problem equally important at the moment, such as Mrs. Garcia's, who comes up to my office all in a dither with, "Oh, Mrs. Tibbet, what can I do? My mother or neighbor, or whoever the case may be, can't take care of my children any more." We know she can't work and leave her children alone, so we refer her to the day nursery nearest her home. Or perhaps her problem is an erring husband.

All these help to keep people happily on the job. We have reunions, weddings, the lead work woman has a birthday and her group treat her to a birthday cake and gifts. Emotions play a large part in the psychological problem of the employment of women.

Otto Jabelmann

OTTO JABELMANN, vice-president — research and mechanical standards, Union Pacific, went abroad last fall on a special mission in connection with lend-lease distribution. The purpose was to give any help he could to the British railways, and especially regarding mechanical matters. He died suddenly in London on January 6. Sir Harold Hartley, vice-president of the London, Midland & Scottish of England, who is widely known in this coun-



Otto Jabelmann

British railway executive tells of his mission to England

articulated steam locomotive on the Union Pacific, but were not perhaps prepared for the swift and discerning way in which he grasped our problems, which are so very different from those of his own railroad.

"As soon as he arrived he said he wanted to see things for himself, and during his short stay here he made a good many journeys, visiting railway shops, roundhouses, and marshalling yards, and wherever he went his keen observant eye was marking down points for discussion with us. We were particularly grateful to him because, in spite of the great differences between his rolling stock and operating conditions and ours, he saw so quickly the causes of our difficulties and the quickest means of overcoming them.

"One night at dinner he met a group of works superintendents and the heads of our research sections, and he gave them a most stimulating talk which they will long remember. Starting rather shyly in his modest way, he first paid a generous and discerning tribute to the war effort of the British railways. Then he told us a little about himself, and as he warmed to his subject he gave us a fascinating account of the developments on the Union Pacific—his two years in Chicago working out the details of the streamliners; and the problems that had to be solved in the newer types of steam locomotives. He was talking to a technical audience, and they enjoyed enormously his infectious enthusiasm and the clarity with which he explained the logical train of thought and resourcefulness that lay behind each technological development. It was a great experience to listen to him, and afterwards they talked with him in turn, each carrying away some new idea, some fresh slant on their problems.

"His last journey to Scotland I made with him in a business car, and ten hours never seemed to pass so quickly. Very little escaped him, and the engineers who were with us were kept busy answering questions. There's a good deal of history in the line from Euston to Glasgow, and Mr. Jabelmann seemed to enjoy it all so much.

"When it got dark I suggested pulling down the blinds. 'No,' said Mr. Jabelmann, 'I always sit in the dark and watch the road; you see things by night you don't see by day.' Within a few minutes we passed an engine with its brakes badly adjusted and sparks flying from one wheel. 'Now you couldn't have seen that by daylight,' he said.

"In Scotland he spent a good deal of his time at a roundhouse, studying the diagramming of the engines and the methods of repair. No detail was too small for him; nothing seemed to escape his eye and the staff thoroughly enjoyed his visit.

"Two days later, after a visit to a locomotive works, he collapsed, and died shortly afterwards. He had caught a cold on the journey to England; he knew he was not fit, but he was unsparing of himself on his mission. And so he gave his life to the cause of the United Nations, busy and active to the end."

ry, came in intimate contact with Mr. Jabelmann and has recently written the following impressive tribute to him:

"The sympathy of British railwaymen goes out to their American colleagues at the sad death of Otto Jabelmann while on a mission to this country. Although few of us had known Mr. Jabelmann previously, all who met him realized quickly how admirably qualified he was to discover in what ways the United States could help us most to solve some of the war problems of the British railways. With his long operating experience, his great technical ability, his quick eye and his sympathetic approach to any problem he quickly won the confidence of his British colleagues. We knew of the great work he had done in the development of the Diesel-electric streamliners and the



Accidents Worse Than War

ELMER DAVIS, director of the Office of War Information, has pointed out that "job accidents have killed more of our productive workers than have the Nazis and Japanese, maimed millions and cost more production time than almost any other cause." Based on the results that have been obtained by the National Safety Council over the years, there seems little question but that a very considerable part of these casualties could be prevented if the managements and workers could be made more safety-minded. This involves more effective safety education programs and a more thorough and studied use of safety devices.

The Committee to Conserve Manpower in War Industries of the United States Department of Labor has prepared a list of "do's and don'ts to keep workers from getting hurt." In introducing the first of these releases it makes the statement that:

"Job accidents in the United States from July, 1940, to January, 1943, the 30 months covering the defense program and the first year of war, brought death to 48,500 workers, cost 258,000 an eye, finger, hand, arm or leg, and laid up 5,300,000 for an average of three weeks each. Days of work lost in these accidents totaled 110,000,000—more than 375,000 man-years. In the first 18 months of the war, our announced battle casualties have numbered 12,123 dead, 15,049 wounded; 40,435 missing and 10,628 prisoners of war, a total of 78,235."

Seven of the series of nine sets of safety suggestions are so applicable to railway mechanical department operations that we are reproducing them herewith:

General Suggestions

1. Work in the shop only when you are physically fit and provided with the proper equipment, tools, and safety devices. Tell your foreman if anything is wrong.
2. Report all unguarded machines or unsafe or insanitary conditions to your foreman or safety committee-man at once.

Many more workers are killed and maimed by accidents in this country than are those numbered in our battle casualties

3. Small cuts or scratches may become infected. Get first aid at once. Report all injuries promptly.
4. Walk—do not run—up and down stairs. Watch your step and keep your hand on the rail. Keep to the right in passing others who are approaching from the opposite direction.
5. Scuffling, horseplay, and practical jokes are dangerous and childish—act your age.
6. Do not use an air hose for dusting clothes or hair. Do not fool with compressed air or blow it at anyone else.
7. Never attempt to enter or leave an elevator while it is in motion, or to operate one unless specifically authorized and instructed how to do so.
8. Do not distract the attention of persons engaged in exacting operations.

Personal Protection

1. Wear snugly fitting clothes. Never wear loose clothes, long sleeves, dangling neckties, loose trouser cuffs, finger rings, or other unsafe apparel while working around machinery.
2. Wear suitable gloves and gauntlets when handling sharp-edged stock, scrap, or quantities of lumber.
3. Wear goggles when grinding, snagging, chipping; pouring hot metal, caustics or acids; welding, sandblasting, or doing any other work where flying or splashing material might enter the eyes (unless an effective non-shatterable shield is installed on the machine). Do not

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interchange goggles, masks, or other personal protective equipment without first having them sterilized.

4. Wear shoes with soles sufficiently heavy to give adequate foot protection. Use safety shoes when handling heavy objects.

Machinery

1. Stop machine or other dangerous operations while listening to instructions.

2. Before cleaning, adjusting, or oiling a machine, make sure that the power is off.

3. Never reach over moving cutters, rolls, or other dangerous machine parts.

4. Always remove chuck wrenches from chucks immediately after they have been used.

5. Stand out of direct line with rapidly moving or revolving machine parts from which objects may fly. Do not stand in line with materials being fed to circular saws or jointers.

6. Always use a push stick when feeding short or narrow work past saws or knives. Keep fingers away from moving machine parts.

7. When operating any machine, do not lean over the work so that your hair or clothing may be caught in any moving part.

8. Do not start any machine unless safeguards are in place and working properly. Machine guards may be removed only to make necessary adjustments and repairs, and must be replaced before the machine is again put into operation. If guards become broken or inoperative, the machine should be shut down until it can again be operated in a fully guarded condition.

9. Never attempt to stop a machine by grabbing the belt or by using any part of the body as a brake.

10. When replacing the belt, stop the machine and adjust belt on the driver pulley first.

11. When shifting a belt, use belt shifter or a small metal or wooden rod. If you must shift by hand, always use the palm with the thumb and fingers extended.

12. Metal belt fasteners should never be used on hand-shifted belts.

13. Remove chips or materials from around moving machine parts with a brush or stick, never with the hand.

14. Keep loose materials away from machinery. Do not use rags or waste around moving machinery parts.

15. Machines should be stopped before attempting to pick up tools or other objects lying near or in the path of traveling parts.

16. Always turn off the power on a machine before attempting to remove stuck or jammed pieces of material.

Hand Tools

1. Use only tools that are properly sharpened and in good condition.

2. Use suitable shields to cover the dangerous parts of sharp-edged or pointed tools that must be carried about.

3. Use only tools free from broken or splintered parts. Be sure that hammer heads are secure on handles.

4. Chisels, hammers, or other tools on which the heads have become mushroomed should not be used.

5. When using wrenches, be sure that the jaws are not sprung and that they are properly applied to the nut, so that the wrench handle will turn in the direction in which the jaws point. Never use a wrench or any other makeshift as a hammer.

6. Use wrenches properly sized for the job; be certain that the wrench is correctly applied to the nut or bolt head. Where necessary to push against a wrench handle in close places, push with the hand open.

Ladders and Scaffolds

1. Use care in placing a ladder; the foot should be one-fourth of the ladder length away from the wall against which the ladder is leaning.

2. Do not leave tools on top of a stepladder or on any other elevated place from which they may fall. Effective tool holders should be used.

3. Place ladders only against solid and stationary backing.

4. Always face the ladder when ascending or descending. Use both hands going up or down a ladder.

5. Use only ladders in good repair. Never use a broken or weak ladder or a ladder with missing rungs.

6. No uprights, braces, or supporting members of any scaffold should be removed, loosened, or weakened while any of the scaffold planking or flooring is in place.

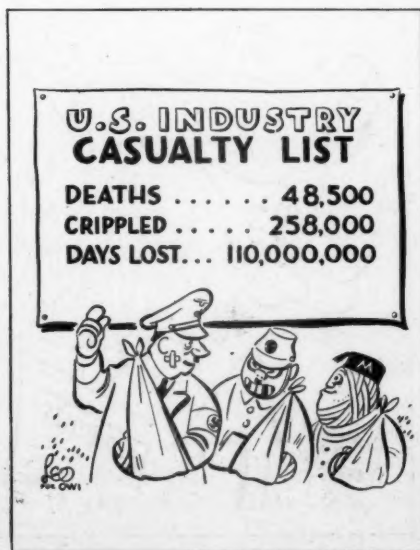
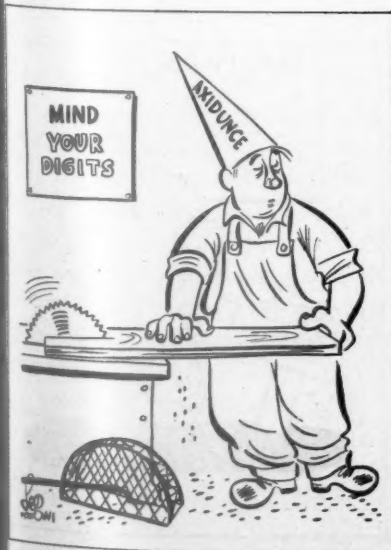
Material Handling and Storing

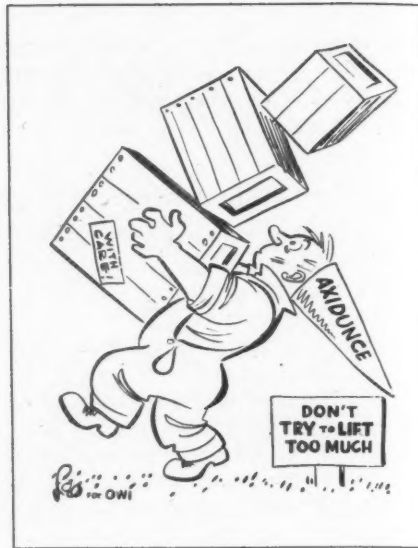
1. Learn to lift the right way. Keep the body upright; lift with the leg muscles and not with the back. Do not try to lift too much. Get help if necessary.

2. Wear hand pads or gloves when handling sharp-edged scrap or rough material.

3. Remove all projecting nails from barrels, crates, and all other places where they might cause accidents.

4. Keep floors clean. Oil or water is especially dan-





gerous on floors near machines, near sharp-edged tools or materials.

5. Do not use gasoline or other inflammable substances in a closed room or near an open flame or on a hot surface.

6. All oils, paints, and other inflammable or explosive substances should be stored in specially provided safety containers, and only small quantities of such materials (never more than a day's supply) should be taken into the workroom at one time. Containers for inflammable substances should be marked with proper identification and never used for any other purpose.

7. Arrange materials carefully and securely. Do not pile or place objects or materials near machines or in such a position that they can fall over or block passageways.

8. When piling materials, do not leave projecting edges or points against which someone may strike.

9. Put all scraps and waste materials into proper receptacles. Keep oily and paint-covered rags in closed metal containers.

10. Keep all aisles and exits clear.

Broad Recommendations

1. *Work Safely.*—Find the safest way to do each job, then do it that way until it becomes a habit.

2. *Use Guards.*—Use all machinery guards and protective equipment provided for your use.

3. *Observe Safety Rules.*—Keep from getting hurt observing safety rules and instructions.

4. *Report Hazards.*—Report to your safety committee, foreman, or supervisor any hazardous conditions that you find on your job.

5. *Fellow Workers.*—Watch out for the safety of your fellow workers.

6. *Safety Committees.*—Work with the safety committee in your shop. If there is none, try to organize one and assist in its work through safety and health hazard check-ups, inspections, and accident investigations.

7. *Personal Hygiene.*—Ability to produce depends upon physical fitness; therefore, use all sanitary and hygienic facilities provided. Do not eat at your bench.

8. *Neatness.*—Since "housekeeping" is an effective safety measure, keep your bench, machine, or other work place clean and neat.

9. *Cooperate.*—Cooperate with the government, with your employer, and with your fellow workers in the efforts to reduce industrial accidents and diseases.

10. *Remember.*—Remember that it is your life, your health, your limbs, your pay envelope, and your family welfare. Make sure that your job is safe—first, last, and always.



EDITORIALS

What Can Be Done?

Modern locomotives—fine specimens of machinery that are utilized and stressed to the limit of their capacity—require the very best of care to protect them and keep them in prime operating condition. Unfortunately, a little carelessness in finishing some of the parts, or hammer marks, nicks, torch burns, etc., incurred in their operation and maintenance, may and do develop into major defects that cause failures. Such things must be carefully guarded against and prevented. What can be done to protect and insure vital machinery part surfaces from such abuses? That is a question that we should like to have answered in our August Roundtable discussion. Your letter must reach our New York Office as promptly as possible, and not later than July 15.

Plastics and Their Use on the Railroads

The result of the roundtable discussion on the use of plastics in car construction, which will be found elsewhere in this issue, is conclusive in one respect, at least, and that is, that railroad mechanical men have had only very limited experience with the use of plastics. There is a lack of specific information about the properties and characteristics of the newer forms of this material, which are reported to be giving excellent results in war equipment. In light of the very obvious need for more information about plastics and the possibilities for their use on the railroads, the *Railway Mechanical Engineer* is preparing an article for publication in a later issue, that will more fully meet the needs of the railroad mechanical department.

The educational work in familiarizing motive power and rolling equipment officers with the characteristics of these increasingly useful products will undoubtedly be carried on by all manufacturers who are interested in the railroad field as an outlet for their productive capacity which is now almost fully occupied in the output of materials for the war effort. Probably many of the prospective uses are not even being thought of by either the manufacturers or the railroad officers who will be responsible for adapting plastic materials to railroad requirements. It is our hope that the publication of basic information will be helpful in providing a background for study and will encourage designers and producers to consider carefully the introduction of plastic structural materials and accessories better, or as good while being cheaper, than those now in use.

Watch That Curve Now That Summer Is Here

Once again it is time for those who prepare the graphs on hot boxes to sharpen their pencils and cock their straight edges upward on their charts. It would be too much to hope that this annual upward tendency will not occur this year; the chances are that history will repeat itself and the steep climb during July and August will again take place. This is an open invitation to any road which succeeds in flattening out the curve to use our columns to tell their brother railroaders how the feat was accomplished—such information should be broadcast promptly in the interests of the railroads as a whole.

In our June issue four pages of comments from men intimately associated with this problem were published in your *Roundtable*. While it is evident that none of those who participated were able in a short contribution to explore the field thoroughly, it was interesting to note the various points which each chose to emphasize. A determined effort along any single line may result in an appreciable drop in hot journals; a determined campaign along all lines should effect even greater reductions.

Once more it will be that much overworked individual, the supervisor, who must bear the brunt of this demand for fewer hot boxes. Several of the contributors to the *Roundtable* indicated their belief that, with certain practices known to be of help, it was the duty of supervision to see that the practices were followed out to the letter. Those who did not specifically refer to supervision, but who suggested remedies, certainly had in the back of their minds the fact that supervision alone could make the remedies effective.

It will be a hard summer; loadings are increasing, cars will be in great demand, time for adequate attention to the boxes will often be at a premium and the labor problem will not improve. But somehow the problem must be licked; war necessities demand that the traffic movement be speeded up, and this requires the elimination of those factors that slow it down. Hot boxes are not the least of these handicaps.

Relation of Light to Safety

Artificial lighting is installed in railroad service for two primary reasons—to allow employees to work efficiently, and to provide for the movement and comfort of passengers. It is also generally accepted that good lighting promotes safety, but very little quantitative data to prove this point is available. The reason for this lack is obvious since there are few places where accidents occur at a rate to permit the collection of conclusive evidence in a reasonable time. The New York subways, however, afford such an opportunity since they carry more than 5,000,000 passengers daily. Subway train accidents are rare, but people fall while hurrying down stairs to catch a train, when stepping across a space between a car and platform, etc.

A paper on the relation of light to safety was presented before the Illuminating Engineering Society on June 11 by E. E. Dorting, supervisor of lighting, New York City Transit System. Mr. Dorting's findings are based on extensive studies of stair and platform lighting, and over periods varying from 4 to 32 months he has been able to collect some convincing data. His platform lighting was resolved into the use of low general illumination (0.1 foot-candle) with higher values (4 to 6 foot-candles) on platform-edge strips consisting of 8-in. sq. yellow terrazzo tiles. The dark colored platforms reflect only 5 per cent of the incident light while the tiles reflect more illumination, but one which does not cause troublesome glare. Studies made in stations used by as many as 100,000 passengers daily showed that the lighting effected a reduction of accidents of 52 per cent.

In the case of stairs, it was found that good lighting was of little benefit unless the stairs themselves first met certain specifications such as: Riser heights which do not vary more than $\frac{1}{8}$ in. plus or minus; definite relations of riser height to tread width (7 in. by 11 in. are given as a good value); landing widths equal to at least two average human steps; level treads and landings; tread edgings in line; handrails on both sides with a center rail when stair widths exceed 132 in.; stair treads which reflect 50 per cent of the incident light. Given these conditions it can be proved that good lighting, which is applied particularly for those descending the stairs, will materially reduce accidents. Based

on a series of stair-lighting studies showing various results the author says, "the intelligent application of artificial illumination should reduce the number of accidents by at least 50 per cent."

With relation to lighting for railroad workers, it is interesting to note that the number of accidents resulting in personal injuries rise and fall at a rate which is much greater than the rise and fall in the number of employees. As an example, during 1941 and 1942 when the number of railroad employees increased 24 per cent, the number of railroad employees on duty increased 24 per cent and fatalities to non-train employees on duty increased 88.6 per cent and injuries increased 88.6 per cent. Conversely, during 1931 and 1932, when employment declined 30.7 per cent, the decreases in fatalities and injuries to the same class of employees were respectively 63.5 and 53.1 per cent. Other periods show similar trends.

The increased number of accidents is probably due partly to the use of relatively inexperienced workers and partly due to the fact that routines are upset and a large part of all employees are required to perform unfamiliar tasks, work which makes it necessary for them to think about what they are doing.

The obvious suggestion, based on Mr. Dorting's findings is that light can also be used advantageously to reduce accidents to employees as well as passengers. Railroad properties, due to their sprawling character and the presence of much smoke and dirt, present a difficult lighting problem. It is not to be supposed that all areas could be well lighted; and under present material restrictions, the relighting of even strategic important points may involve almost insuperable difficulties. It is, of course, possible to carry on with inadequate light, but experience with blackouts has proved that it greatly increases the accident rate. Saving material is important, but it would appear that more attention to lighting might result in an important saving of man power.

How Much Do Shop Men Care?

By and large, there is no question about the faithfulness and loyalty of railway shop supervisors, mechanics, machinists, helpers and, in fact, employees of all classes. They realize the vital relation of their work to the war effort and appreciate the opportunity to make a livelihood in an industry which contributes so much to business progress and national welfare. Unfortunately there are some exceptions, and instances of carelessness or indifference occur which really in no way disprove the rule.

For example, one railroad which had embarked on a car building program recently transferred its lathe bending brake, practically a new machine, from the shop to the boiler shop where the particular set

mitted steel sheets to be flanged and shaped with increased handling expense. The machine was designed to bend 12-ft. sheets up to $\frac{3}{8}$ in. in maximum thickness. This capacity range was, or should have been, only shown on the name plate, or some conspicuous part of the machine, for the information of all who used it. The instructions, if given, were disregarded and a steel sheet, $\frac{5}{8}$ in. thick, was inserted in the brake, causing a failure of the side housings and pressure-applying machinery which put the brake out of commission for a considerable period of time; entailed a considerable item of expense for the replacement of parts; and, possibly even more costly in the long run, interfered with production and delayed the completion of freight cars badly needed to move war and civilian traffic. Machinery accidents are sometimes caused by shop men who do not have any "feel" regarding machine capacity and are skeptical about rated capacity limits. Consequently, they simply keep on increasing the load, feed, or feed, as the case may be, until machines will hold together no longer. Such abuse, which tends to break the heart of any real lover of fine shop machinery, must be charged to bad judgment and ignorance, and men with such characteristics should not be permitted to operate shop machinery, certainly not unless it is fully protected with automatic safeguards. The other type of man who should be kept away from shop machinery is the one who is indifferent and careless. This calls to mind the story of the farmer who was harvesting between rows of young corn and discovered that his mule was wobbling from side to side and stepping on nearly every other hill. Questioned as to whether his mule might be blind, the farmer said, "No, he ain't blind. He just don't give a damn!" It is well for the railroads and the country at large that not many men responsible for operating railway shop machinery, or equipment can be placed in a similar category as regards carelessness.

What Price Supervision?

A lot of the supervisor or foreman on most railroads has never been an especially happy one. True, such positions usually carry with them a certain element of security in bad times which tends to make up for long hours spent on responsible jobs. But today supervisors are getting tired; the pressure has been on for several years and life has not been made easier for them. The large turnover in help and the shortage of repair materials now common on all roads. That these men have carried their share of the load efficiently is evidenced by the low bad-order ratio of freight car equipment and the excellent maintenance of locomotive power.

The need for additional supervisors in the mechanical department has been emphasized before; the need now

for the recognition of supervisors as contributors to efficient production is becoming increasingly evident. With the increase in working hours at many back shops, car repair and inspection points which requires the payment of overtime to mechanics, helpers and laborers, a supervisor frequently finds that, on pay day, his men have drawn more money than he has himself. He cannot help but reflect that he, too, had spent the same working hours, and usually more, on the job and, in addition, was responsible for the quality of output. With the present recommended increase in pay rates for non-operating employees the situation will not improve.

Morale is a vital factor in maintaining an efficient working organization in any industry. Supervision is usually depended upon to contribute very largely to the creation and maintenance of morale or job enthusiasm. When foremen are dissatisfied the results must inevitably be reflected in their own work and that of the men who depend upon them for leadership.

Some roads have recognized the importance of the supervisor in the framework of their organization. One system has recently gone to a six-day week for foremen with a limit of nine working hours per day. Time over 54 hours is paid for as in the case of all workmen who are required to put in overtime. Other roads are understood to have similar arrangements or to have attempted to limit the hours on duty required of foremen.

In other instances, however, determined efforts are being made by supervisory personnel to organize foremen's unions. Such movements are receiving the interested attention and support of the organizers and representatives of the non-operating brotherhoods. It is too early in the game to know what the results will be but it is not too early to hazard the guess that foremen's unions will add one more big headache for the officers of any road on which they establish a foothold.

We have for years contended that the worth and value of foremen on the railroads was not always considered by management, especially in the matter of hours of work. We regret now to see that these men are being forced into organized effort to better their lot. Undivided allegiance and loyalty to management is a prime requisite in a good supervisor; divided allegiance and loyalty can only result in cases where management wishes and union policy conflict.

We have talked with many foremen recently in an attempt to estimate their true feelings with respect to organization. Almost invariably, on roads where the movement is gaining headway, the response is, "It's the only way we can get anything." Most of the men contacted are not really enthusiastic but, having waited for recognition which did not come, they are apparently willing to submerge their individuality in a union and attempt mass pressure. The eventual price to the railroads through the creation of another labor-management "problem" may be far greater than the present voluntary recognition of supervisors as co-workers with management.

Use of Plastics in Car

How About Shock Resistance?

I have a question—I wish to know the tensile strength or the shock that plastics can stand.—*J. P. Christiansen, Mechanical Engineer, Chicago, Indianapolis & Louisville.*

Plastic Specifications

Actual results in the field of plastics are perhaps less amazing than the claims which have been made by enthusiastic advocates. After the war is over, to judge by the advance publicity, railroad officials will be visited by the plastic salesmen, and there is certainly an opportunity for the *Railway Mechanical Engineer* to present a few of the basic facts regarding the origin and characteristics of various kinds of plastics. These have both vegetable and mineral origin, and probably combinations of the two. The physical characteristics of various compounds vary widely, particularly with respect to high and low temperatures. Some are sensitive to acids and some are sensitive to alkalis and the information available to the busy railway mechanical engineer is very limited.

As a suggestion, A. S. T. M. Committee D-20 on Plastics has recently evolved six specifications which are factual and informing. Other specifications are in course of evolution. A railroad officer who desires to fortify himself with information in this field would make no mistake in obtaining copies of these specifications, which are D-700 to D-705, inclusive.—*Engineer of Tests.*

Plastics vs. Metals

Up to the present time our experience has been confined to the use of various types of compositions for such items as table tops, window sill capping, transparent portions of partitions, lamp shades, moldings, ornamental trim and similar details.

Realizing the possibilities and advantages in extending the use of plastics for other purposes, we have given the matter considerable thought and study and while we are not yet in position to make any definite recommendations, we feel confident that after the war, when the materials will be made available for commercial purposes, a much larger field will be opened up and the use of plastics extended to include a great many items which have heretofore been of metal. The susceptibility to forming and practically unlimited selection of coloring are outstanding advantages favoring the use of plastics for interior trimming and decorations of passenger cars.

Believe we are correct in understanding that plastics cannot be used effectively for parts subject to stress or excessive vibration, except in connection with some sort of reinforcement, such as plywood or other foundation. The roundtable discussion will no doubt bring out some valuable information on this phase of the subject.

Another important question on which information is desired is the cost of molds. Investigation which we made sometime ago in connection with the possibility of substituting plastics for certain metal parts of parcel racks, developed that unless designs are fairly well standardized, the cost of molds would be prohibitive, which in itself would represent a handicap to injecting variations in interior treatment and fittings, in line with each road's desire to provide distinctive features in the building of new equipment or modernization of existing cars.

In addition to the interest in this subject on the part of the railroads, the industrial designers are actively exploring further adaptations and possibilities, and the experience which the manufacturers of plastics have had in developing numerous uses for their product in connection with the war effort will, we believe, place them in position to readily adapt their product and production methods to peacetime purposes.—*P. W. Kiefer, Chief Engineer Motive Power and Rolling Stock, New York Central.*

Passenger Car Uses

I, for one, believe that plastics will come into use, particularly in passenger equipment. If one can believe our chemists and manufacturers, not only plastics, but other synthetic products as well, can and will be used in car building and remodeling by the railroads.

In order to reduce the cost and weight of new cars, plastic panels can be used as interior finish. Moldings, window caps, curtain slides, venetian blinds, certain types of electrical control panels, towel dispensers, cup vendors and the like can be easily formed from plastics. It is not assuming too much to expect wash basins, dental basins and like equipment from molded or pressed plastics in the near future.

Where plastic panels and molding are used as interior finish, color schemes may be obtained when the plastic panels are manufactured; this will reduce one item of expense, that of repainting, which in itself is a considerable item over a period of years.

I believe we can look forward to certain types of plastic gears, pulleys, and

even perforated air delivery grilles and the like, as manufacturers improve the equipment.

As for synthetic materials, cloths for holstering, berth curtains, window shades and like equipment can and will be made from synthetic fibers, while the uses of synthetic rubber products such as air for cushions, mattresses, Duprene or other like products for window seals, truck and bolster anchors, buffer casting and generator mounting silencer pads may be universal on new cars.

Railroads and car builders should start now to plan their post-war needs and equipment, in order to maintain their place in the transportation field by use of modern passenger equipment that will meet the competition of other types of transportation, which are developing so rapidly. *J. V. Dobbs, Car Lighting and Air Conditioning Inspector, A. T. & S. F.*

Electrical Conduit Fittings

The use of plastics in car construction raises the question of plastics for electrical conduit fittings, which may be of interest.

Plastic conduit would, of course, require proper characteristics to combat the various physical and chemical conditions encountered, both underground and above ground. Conduit and fittings would have to be water-tight, heat resisting, fireproof, mechanically strong, non-corrodible and have a long, useful life. The electrical organizations of railroads have long been confronted with the problems brought about by rapid deterioration of exposed conduit and fittings at enginehouses and associated facilities, due to gas, cinders and moisture. In many cases the ash and cinder fills make necessary special treatment of trenches for underground runs of conduit on railroad property, and even then rapid deterioration frequently occurs.

It is within reason to expect that development could produce a plastic conduit which would machine and thread to furnish water-tight joints and even provide for making bends and offsets on the job in runs, without the necessity of fitting. Junction boxes of suitable plastic construction would, with their dielectric properties, avoid one of the most frequent sources of trouble—abrading of the insulation and grounding due to vibration, the sides or cover of the metal junction box.

The equipment ground problem would have to be solved (in some cases); however, the advantage of dielectric strength and freedom from electrolytic action should

Car Construction

considerable. A ground conductor could readily be run with the other conductors in the conduit, and satisfactorily solve this problem.

Light weight per unit of length should contribute materially to facility in handling and installation, particularly on the railroads, where in many instances conduit must be installed in inaccessible locations and distant from the source of supply.

Expansion and contraction of long conduit runs should be considered in the development of the material to avoid separation of conduit and entrance of moisture into the system. These are a few of the thoughts which occur at the moment and undoubtedly other problems would develop with use; however, there certainly seems to be a definite field for additional use of plastics in the electrical branch of railroading.—G. M. Heinze, Assistant Engineer, Electrical Engineer's Office, N. Y. N. H. & H.

What Are Their Limitations?

The replacement of metals, generally, by plastic materials in car construction cannot be predicted in the present stage of development, because while great strides have been made in the plastic industry, especially in aircraft construction, this material is in its infancy, insofar as railroads are concerned.

At present even the most conservative car designer cannot object to the use of plastic materials for interior decoration and trimmings of passenger cars and for non-stressed parts, such as panels, partitions, air conditioning ducts, ventilators, roof sections, etc., provided, under emergency conditions, other materials were not readily available and, under normal conditions, it could be economically justified.

It is thought that unless standard materials become more scarce than they are at present, plastics will not become prominent through their uses in railroad work during the present emergency, because with the tremendous job that is now being done by the railroads and the absolute necessity of handling this vast business quickly and safely, it would not be desirable to experiment with new ideas and unproved materials and designs.

A common carrier, particularly one handling the volume of public business that is handled by the railroads today, has to be very slow to change its general practices that have been proved and tested for years; therefore, if and when plastics are adopted as substitutes for metals, it will be necessary to first study closely the properties of this new material carefully, then conduct laboratory and service tests

for a sufficient time to definitely determine that no chance is taken with the lives or property of the railroads and the public. Therefore, as stated previously, it is very doubtful that there is now available sufficient time or non-productive man-hours to undertake a problem of this magnitude.

Let us now look at another side of the picture; that is, let's look into the future of post-war conditions and suppose that plastics can be produced in great volume at reasonable costs, making them an economic competitor of metals. Our first thought is, will plastics be a safe substitute and what advantages will we hope to obtain from their use?

In order to answer the first part of this question we must first look to our test laboratories. We must know such things as tensile strength, toughness, hardness, fatigue resistance, etc. We must then conduct service tests, experiment with design, study weights and analyze resistances to know inherent defects caused in previously used materials.

In answering the second part of our question, let us look at some of the undesirable properties of the metal that leads all others in use, namely steel.

First, it is subject to corrosion. Second, it has to be varied in properties to produce wear resistance, strength or fatigue resistance. Third, it is subject to progressive failures starting from surface or material defects.

The best illustration of the desirability of obtaining a non-corrosive material to substitute for steel is in the case of open top cars, particularly those handling coal exclusively. If a plastic sheet could be developed that could be used for coal car sides, bottoms and hoppers that had the strength and toughness and that would be hard enough to resist the abrasion and at the same time be non-corrosive, it would revolutionize the construction of this type of car.

In thinking of wear resistance we think first of wheels, because approximately one-third of the cost of maintenance of freight cars is wheel expense. The greatest wear experienced usually is in the flange and tread; therefore, we may ask, why not increase the hardness? This has been done to some extent by heat treatment, but we know from experience that when a certain hardness is exceeded, we are liable to run into brittleness and the wheels are more susceptible to thermal cracking. Again, if plastic can be produced that will have the necessary strength and toughness to withstand wheel service and at the same time have sufficient hardness to produce a longer life, much will be accomplished in reducing car repair costs. This may sound like wishful thinking; however, we must not overlook the fact that compressed paper has been used as traction car wheels, con-

sequently such a plastic may be in the realm of possibility.

The third property referred to in our list is especially troublesome in parts subject to stress reversals. In the case of axles, for example, numerous failures occur because of "tool marks," "rough fillets," nicks caused by handling or shipments of mounted assemblies of wheels and axles, etc. Likewise, there are numerous pipe failures that originate at the root of the thread brought about by vibration. If plastics could be developed that would have sufficient resilience to stand the vibration and still have sufficient strength, or if they were of such a fibrous composition as to resist the progressive cracks originating from surface defects, and yet have the other necessary qualities to meet railroad service conditions, their use may be far-reaching in car design.

In conclusion, it is well to repeat that the plastic child has not yet even reached the adolescent stage and it is now not possible to say how useful he will be when he grows up.—J. B. Blackburn, Mechanical Engineer, Chesapeake & Ohio.

Electrical and Ornamental Parts

So far we have not resorted to plastic materials, except in miscellaneous electrical plugs, attachments, lamp shades, and in a few cases, ornamental materials; however, I believe there is a large field for this type of construction.—E. L. Cook, Mechanical Engineer, Seaboard Air Line.

Almost Purely Experimental

We have read of the different uses which are being made of plastics, both molded and laminated, and naturally, since most of this plastic is going into war materials, it is a military secret and the details are not given out.

We have used molded plastics in items of passenger car finishes, and at the present time we are checking to see whether we can use molded plastics for our toilets where we desire to eliminate all corners, presenting a toilet room which can be flushed out with a hose and quickly and easily cleaned. This, however, at the present time is in a purely experimental stage.

I do not believe we will know definitely what can be done with laminated plastics in car construction work until more data is available as to what use has already been made of this material.—Engineer of Motive Power and Equipment.

THE READER'S PAGE

64 Volts For Passenger Cars

TO THE EDITOR:

Your editorial in the May issue on "110 Volts for Passenger Cars" contains a number of claims, some direct and some implied, which I believe are misleading. If a review of the car lighting systems available and their possibilities for the future were intended, with this system recommended as the best, a number of important items were certainly overlooked.

It is stated that cars equipped with the 110-volt system do not require charging at Jacksonville Terminal, with the inference that that system is responsible for the elimination of yard charging there. Yard charging requirements depend on the size of battery and generator and the kind of run. There are certain kinds of runs in which it is impossible to keep a car charged with any axle driven generator system, because the car is not in motion enough of the time. It is quite likely that these particular 110-volt cars have ample size batteries and generators, and their runs are such that they have sufficient time in which to charge the batteries.

The statement is made that 110-volt incandescent lamps are available everywhere and at a lower cost than 32-volt lamps. (Due to W.P.B. orders these voltages are now 115 and 30 volts). However, no mention is made of the fact that a 115-volt lamp has only 79 per cent of the lumen output of a 30-volt lamp (40-watt size), nor that its filament is more fragile. Furthermore any lamp of a household voltage is likely to be stolen, particularly if installed in open-mouthed fixtures. The resulting increased lamp consumption might largely, if not entirely, offset the lower cost.

The statement is made that wayside a.c. power (presumably 110 volts) can be used for lighting cars while standing. I question the implication that 110 volts a.c. is available everywhere. It is not in many railroad yards at present, at least not in sufficient capacity to supply the lamp load on any great number of modern cars. The power supply that is being adopted as a standard wayside a.c. supply is 220 volts, 3-phase, and this soon will be available nearly everywhere that cars are laid up. Cars equipped with Genemotors designed for operation from this supply will become more frequent in the future and on such cars the lamp voltage can be any desired value.

I question the statement that a large number of battery cells with a small number of plates in parallel will give better performance than fewer cells with a larger number of plates in parallel. Ordinarily the fewer the cells in the battery the better, *from the standpoint of the battery only*. The batteries for the 110-volt system cost more, weigh more and the cost of flushing and the liability of damage due to missing a cell when flushing is much greater with a total of 56 cells than with 16 cells. The Proceedings of the A.R.E.E. October 27-29, 1936, page 115, discuss quite

thoroughly the relative merits of the three voltages 32, 64 and 110 volts, and give comparative battery statistics.

The present widespread adoption of 32-cell starting and lighting batteries on Diesel-electric locomotives in place of the 56-cell batteries originally used also points to the desirability of keeping the number of cells to the minimum consistent with all the conditions to be met.

The main reason for the adoption of a voltage higher than 32 on cars is that the cables (and motor commutators) are too large when 32 volts is used with electro-mechanical air conditioning equipment. Also, two-cell units of a battery of 1,000-1,200-amp.-hr. capacity are too heavy for two men to handle easily. The use of 32 cells reduces the weight of a two-cell unit to approximately 250 lb. maximum, which two men can handle reasonably well. A greater number of cells increases the cost and weight of the battery without a commensurate gain in ease of handling the individual units. The reduction in the size of wiring in going from 64 volts to 110 volts is not nearly as important as when going from 32 volts to 64 volts.

While fluorescent lamps can be operated without conversion equipment on either 60 or 110 volts d.c., I understand that the Norfolk & Western is no longer operating them on 110 volts d.c. on the one car described in the Railway Electrical Engineer, July, 1940, page 133.

While I agree that the 32-volt system is not desirable for use with electro-mechanical air conditioning equipment, I believe that the 64-volt system using 32 cells of battery should not have been passed over with as little consideration as was done in your editorial.

In my opinion, the 64-volt system is the best all around system for use with electro-mechanical air conditioning and axle driven generators. We now have in service on the New York Central 717 cars with electro-mechanical air conditioning equipped with this system, including 40 cars with 60 volt d.c. fluorescent lighting. Practically all of these cars have 32-cell, 600-amp.-hr. batteries and 20-kw. generators or Genemotors. While I cannot say that they never require yard charging, this occurs very seldom, and when it does, is due primarily to failures of regulating or mechanical equipment, rather than any inability of the generator to keep the battery charged. When this system is used with a 20-kw. Genemotor, thus permitting yard charging from 220-volt, 3-phase a.c. supply lines, it provides as near an ideal system as can be obtained with any arrangement that depends on motion of the car to operate the generator.

Please refer also to my discussion of 32 vs. 64 volt systems in Railway Electrical Engineer, November, 1938, page 237.

An article comparing the 32-, 64- and 110-volt systems with and without Genemotors, based on present day practice, would be very desirable for reference when we are once more able to undertake improvements on passenger cars.

W. S. H. HAMILTON,
Equipment electrical engineer,
New York Central System,
New York.

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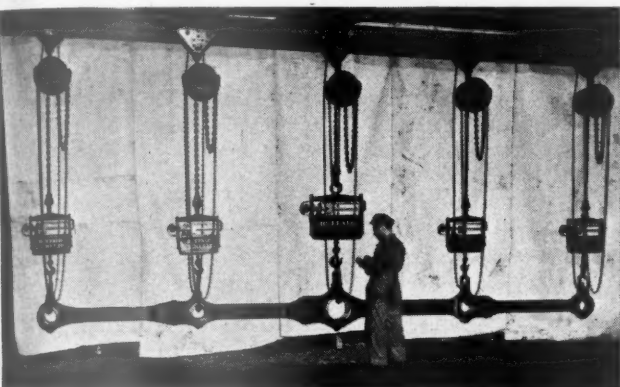
Accurate Determination Of Locomotive Counterbalance

The Erie has recently installed in its locomotive shop at Hornell, N. Y., a new unit for determining the exact counterbalancing required on locomotives passing through the shop. The former method of weighing rods required the use of platform scales with the rods support-

same capacity as the hoists to which they are attached are equipped with hooks which pass through the crank pin bushing holes. The center unit is attached to the middle connection on the rods and the other scales attached at their proper points. The chain hoists are used to level the rods and the scale readings are taken to determine the counterbalancing necessary on the driving wheels. More efficient locomotive performance is resulting from the greater accuracy in determining rod weights.

Cylinder Sleeve Extractor

The extraction of cylinder sleeves, or bushings, from the block of an internal combustion engine equipped with removable sleeves is difficult when the lower end of the sleeve has been broken away or is irregular as a result of a wrist pin, piston or correcting rod failure. Usually no seat is left for conventional type sleeve pullers to act upon.



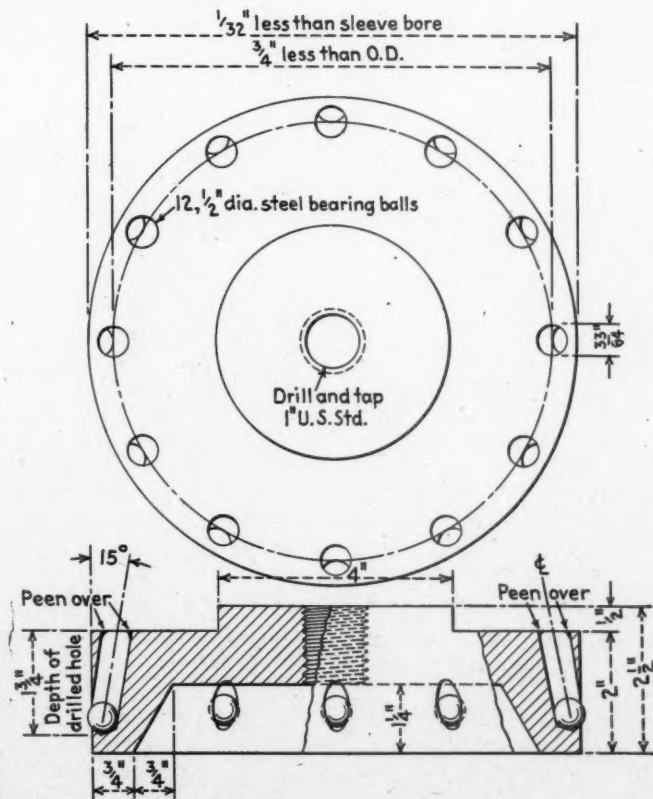
Rod weights are determined with maximum accuracy with this new scale arrangement

ed on V-blocks for leveling. This operation required the use of great care in leveling and results were not always satisfactory; reweighing of the same rods often produced results far different than those obtained in earlier weighings. The time required under the new system is only half that formerly required to weigh each set of rods and the results are much more accurate.

Five Yale trolleys have been mounted on a 12 in. I-beam and from these five Yale chain hoists are suspended. The center hoist is of 5000 lb. capacity, the others are of 2500 lb. capacity. Buffalo scales of the



Chain hoists are used to bring rods to level position for weighing



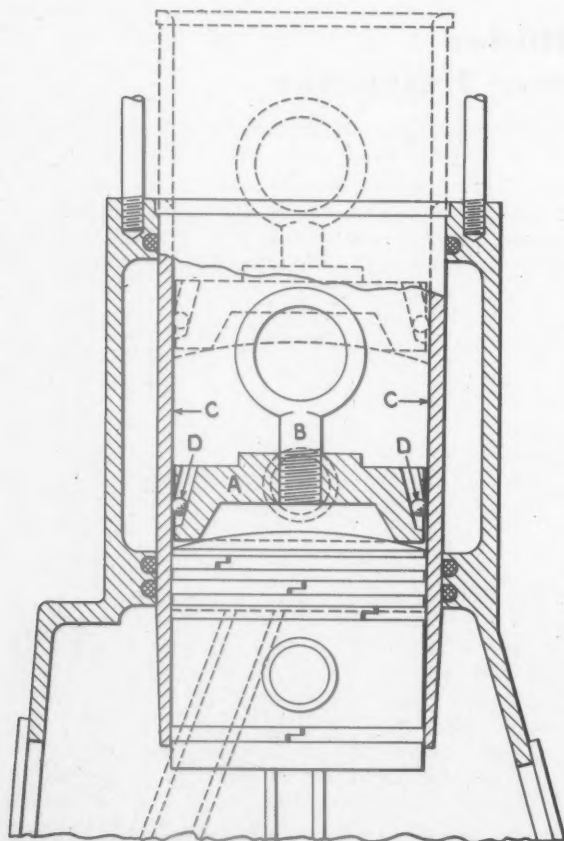
Extractors to remove cylinder sleeves from motor blocks depend upon the gripping action of steel balls against the sleeve walls

Other conditions may also be present to make removal difficult.

A sleeve extractor which will function efficiently can be built in any railroad shop. The stock used should be of a good grade of steel; discs cut transversely from scrap locomotive crank pins or axles make good blanks and

eliminate a forging operation. The upper face of the blank is finished off in a lathe and faced off square. A chucking boss is then machined and, before removing the piece from the first set up, a center hole is drilled in the blank which will tap to a one in. U. S. standard thread. A pitch circle is then scribed on the upper face which is $\frac{3}{4}$ in. less diametrically than the finished outside dimension of the extractor. The blank is reversed in the chuck and the bottom faced off. This surface may be cupped out to reduce the weight of the tool.

Twelve equally spaced $\frac{3}{64}$ in. holes, centering on the pitch circle, are drilled at an angle of 15 deg. from the vertical, pointing outward from the pitch circle. Each of these holes should be drilled to a depth of $1\frac{1}{4}$ in. These holes serve as races for $\frac{1}{2}$ in. steel balls which are the gripping elements in the extractor. The outside of the extractor is finished to a diameter $\frac{1}{32}$ in. less than the



A—The extractor disc
B—Eye bolt, required if outside force is being applied
C—Sleeve wall
D—Extractor unit balls which are forced against the sleeve wall

In many cases the piston itself can be used to furnish the force required to remove a cylinder bushing

nominal bore of the sleeve to be extracted. A one in. threaded hole in the center of the disc provides an anchorage for either a one in. eye-bolt or a one in. draw stud.

When a sleeve is to be removed the extractor is entered at the top of the sleeve. Each ball recedes into its race as it contacts the sleeve wall and permits the unit to be lowered to the desired location. When an upward pull is applied the disc begins to grip against the sleeve wall as each of the balls is forced against the sleeve. The greater the pull exerted, the greater the pulling action of the balls becomes and the sleeve will finally yield to the upward pull being applied. It is also possible to use the device in a motor from which the piston and connecting rod have not been removed without utilizing the eye-bolt

or draw stud. The disc is lowered until it rests upon the piston head. When it is in position the fly wheel of the motor is turned over with a bar which forces the piston upward and, in so doing, tightens the extractor against the sleeve wall.

In employing the latter method care must be taken to position the piston so that the extractor disc does not descend below the upper sleeve seat of the block. This places the crank and connecting rod at the most advantageous leverage position. In addition the block serves as a reinforcement for the thin wall of the sleeve and protects it from distortion from the pressure exerted by the ball.

When sleeves to be removed are still serviceable or can be reclaimed the use of an auxiliary protector ring will protect the sleeve walls from pitting from the pressure of the extractor balls. This arrangement provides only a straight friction grip between the extractor and the sleeve and, for this reason, the extractor should engage below the upper sleeve seat of the block. Otherwise, the slight expansion caused by the action of the extractor might increase the adhesion of the sleeve within the block to such an extent that it would exceed the adhesive strength of the protector ring. The protector ring should be made of bronze and slightly wider than the thickness of the extractor disc. A wall thickness of $\frac{1}{4}$ in. will be satisfactory. The ring should be split on one side and have an outside diameter which provides a forced fit in the sleeve bore. Its inside diameter must permit the free entrance of the extractor unit.

The extractor requires no adjusting or other attention from the crank case end of the cylinder, it will engage with any sleeve regardless of the condition of the lower end or the wear on the sleeve caused by the piston. It permits the extraction and replacement of serviceable sleeves in cases where the pistons and rings are known to be intact without the necessity of removing these parts from the motor. Application and removal of the unit are simple operations.

Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

Bolt Lugs on Trailer Oil Cellars

Q.—Will you recommend a satisfactory welding procedure for broken bolt lugs on trailer oil cellars?

A.—When a large section of a lug is missing it is quite difficult to rebuild the lug and still maintain the correct size of the hole. In such cases bend a piece of $\frac{1}{4}$ -in. plate of the desired width to reassemble the missing piece. The inside dimension of this piece should be the same as the required inside diameter of the hole. Chip, grind or file the cast-iron cellar part of the lug bright and clean. Place the piece of bent plate in position and tack with bronze. Rebuild the lug to the desired size being certain to get a good bond between the bronze and the cast iron.

Brazing Plugs In Cylinder Saddle Holes

Q.—We are changing a number of front frame sections on some heavy freight power. The bolt holes connecting the frame and cylinder have been reamed so much that the holes are very much oversize. We do not wish to drill such large holes in the new frame. Can we bush or fill these holes?

A.—Steel plugs can be turned to fit the holes and driven into the holes flush with the back side of the casting. The plugs are made about $\frac{1}{2}$ in. shorter than the hole on the frame-fit side. After the plugs are driven into the holes the remaining part of the hole is countersunk with an air hammer and chisel. This gives the welding operator an opportunity to braze the plug to the cylinder.

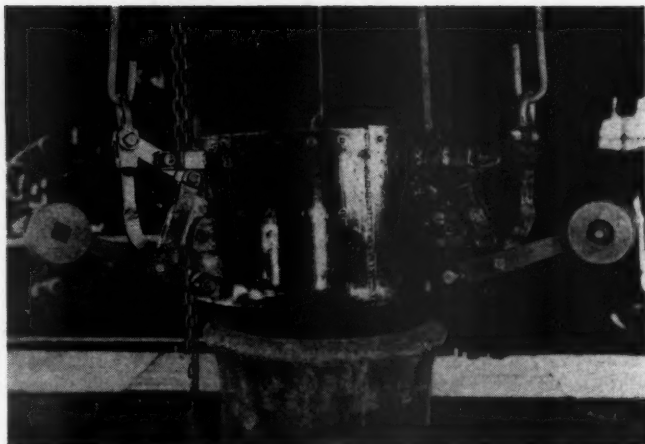
After the brazing operation is completed and while the bronze is still hot, peen the bronze thoroughly with the air hammer and a bobbing pin. Peening will keep the contraction of the applied bronze down to a minimum. The new frame section may now be drilled to standard size and, when placed in position under the cylinder, the holes in the casting can be drilled by following through the holes already in the frame.

Removable Spark Arrester for Locomotives

By S. H. Kahler*

Precautions against fire in industrial plants which might result from the use of coal-burning locomotives in plant properties are especially important in locations where war materials are being produced. A large explosives manufacturer required that a spark arrester of $\frac{3}{8}$ -in. wire mesh be used on locomotives working on its prop-

* Master mechanic, Toledo Terminal, Toledo, O.



The spark arrester in release position—When applied to the stack the counterweights hold the eccentric locking dogs firmly in position on the bell of the stack

erty. It furnished an arrester which was functionally very effective but which was of a type that fastened to the smoke stack by means of four 1-in. set screws.

This mode of application required the engine crews to spend a considerable amount of time on top of the hot smoke box while applying and removing the spark arrester by the tightening or loosening of the set screws. In addition there was a personal injury hazard involved. To save crew time and reduce the danger to employees, a fully self-locking semi-automatic spark arrester was designed and built. It has proved successful in operation and conserves man hours while eliminating unpleasant and possibly hazardous working conditions.

A steel framework was erected on the plant lead track and the arrester is suspended from this framework on a steel cable which runs over several pulleys and is attached to a hand-operated winch on one of the side members of the frame. When a locomotive is spotted under the frame a ladder is placed against the side of the smokebox and the arrester is lowered by operation of the winch to its position on the stack. A crew member releases the clevises on the spark arrester from the hooks on the holder and the dropping of counterweights locks the device in position. The locking feature consists of three dogs made of $\frac{3}{4}$ -in. steel which are connected with levers that engage under the rim of the stack. When the spark arrester is to be removed the clevises on the lever arms are attached to the hooks on the holding device and the spark arrester is raised by the cable and winch to clear the

Positive Clamp Frees Table Space

Clamping work to machine tables by means of U clamps has been changed in some applications as the result of a clamping fixture suggested by an employee at the Schenectady, N. Y. works of the General Electric Company.

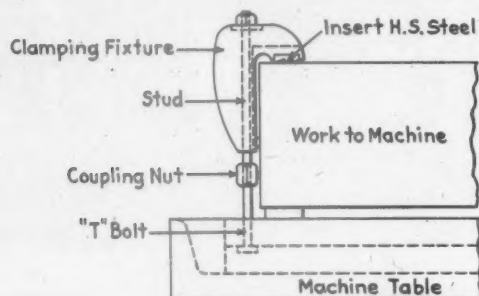
The fixture is a positive clamp with an inserted hardened-steel jaw to prevent slipping. A T-bolt is fitted with a coupling nut so that by varying the length of the stud used, the clamp may be employed on varying thicknesses of work. Since but a negligible amount



Locomotives are spotted under this frame for the application of the spark arrester

Railway Mechanical Engineer
JULY, 1943

of space is needed for fitting the T-bolt into the table, its full length can be utilized. Previously, blocks to support the U clamps took up much working space.

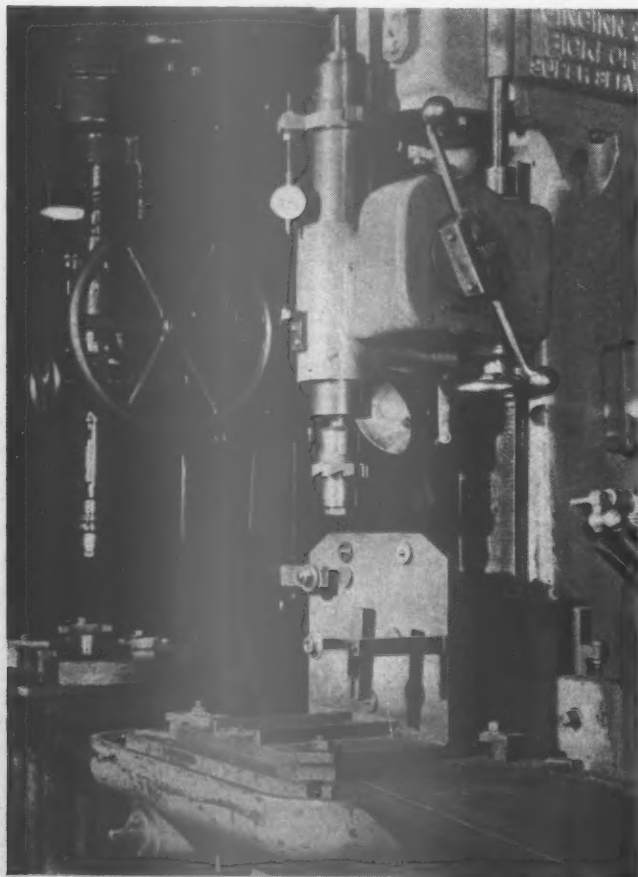


This T-bolt clamp replaces U clamps and frees table space

The clamping fixture is being used successfully on boring mills, planers, and milling machines.

Close Tolerances In Drill-Press Work

Difficulties in holding the depth tolerances of plus or minus .0015 in. in facing operations on heavy-duty drill presses have been overcome at the Appliance division plant of the Westinghouse Electric and Manufacturing Company, East Springfield, Mass. Normal spring and give in machine and fixture made it impossible to work to the regular spindle stop and maintain the required



A dial indicator is mounted on a heavy-duty drill spindle, to help hold close depth tolerances

tolerances. The problem was solved by making a dial indicator attachment mounted on the spindle sleeve. A collar around the spindle sleeve holds a standard .0001-in. dial indicator by means of an adjustable threaded bracket. A stop fixed to the spindle bracket provides the point on which the indicator plunger rests. In operation, the indicator is set to read the last few thousandths of the cut. The spindle is brought down to this point by power feed. The feed is then disengaged and the cut finished by hand feed to the proper depth, as indicated by the dial.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Bolts for Boiler Patches

Q.—Should the thread on boiler patch bolts be tapered or straight?—J. D.

A.—The threads on boiler patch bolts should be straight. In applying these patch bolts the holes in the patch are made $\frac{1}{32}$ in. to $\frac{1}{16}$ in. larger than the diameter of the patch bolt to be used and the boiler sheet is drilled and tapped for the bolt. By using straight threads in the boiler sheet and the patch bolt, the bolt can be tightened until the patch is drawn down tight against the boiler shell, insuring a properly fitted patch on the boiler. If tapered threads are used it is possible for the patch bolt to become tight in the boiler sheet without having drawn the boiler patch firmly against the boiler.

Preparation of Conical Courses

Q.—After rolling a conical boiler course it is necessary to flatten the ends so that the conical course will fit the adjacent straight courses at the circumferential seams. How is this work done?—M. I. T.

A.—There are two methods of flanging the ends of conical courses to fit the adjacent straight courses at the circumferential seams. The method to be used is determined by the facilities of the shop and the taper of the conical course. Shops equipped with hydraulic riveters can do this work with the riveter, if the conical connection does not have too much taper. The plate is flanged cold with the hydraulic riveter. The riveting dies are replaced with flat dies; the rolled cone is suspended by a crane and pressure is applied around the circumference of the conical section until the desired condition is obtained.

When the taper of the conical section is too great or the flange too long for cold bending, as at the front end of a conical first course where the flange is made long for receiving the front tube sheet, the plate is heated around the end in an open blast fire to a red bending heat. The end is then made cylindrical by pounding it with mauls. The correctness of the flanged diameter is checked by running a measuring wheel around the inside surface of the plate.



Steam-hammer operator, Mrs. Elizabeth Barnes, Southern Pacific, Bayshore, Cal.

Negro woman cleaning locomotive in enginehouse, Illinois Central



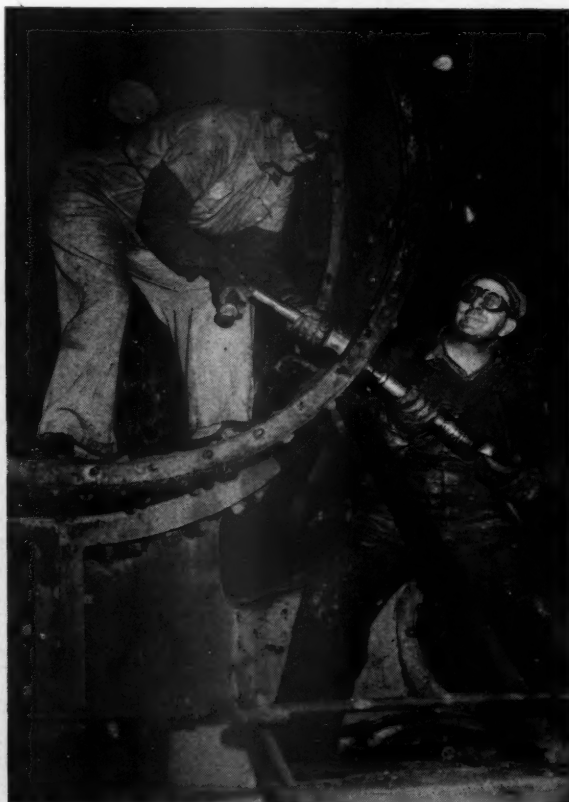
Woman machinist helper, Pennsylvania shops, Wilmington, Del.

Women Workers in the Locomotive Shop

Mrs. Stella Sloop working as a blacksmith helper, Southern Pacific, Portland, Ore.



Cutting shears operated by woman tinsmith helper, Pennsylvania, Wilmington, Del.



Credit Pittsburgh Sun-Telegraph

Mrs. Louise Shaw, boilermaker helper, working with her husband, William R. Shaw, Baltimore & Ohio, Glenwood, Pa.—Recently featured in short-wave overseas broadcast

With the Car Foremen and Inspectors

Wheel Conditions and

Wheel Shop Practices*

ON many occasions I have been compelled to take the position that, if the various rules and regulations of the A.A.R. were complied with, a great improvement would be effected in train operation. If the present war has proven anything it has distinctly shown that nations, organizations and even individuals will not conduct themselves in the society of nations under merely a gentlemen's agreement, and it now appears that, unless the committees and officers of the A.A.R. are delegated with definite authority to enforce the rules and regulations of that body, we cannot expect anything like general compliance with their recommendations.

Flagrant violations of rules governing general freight car and wheel conditions have been exposed in committee reports. Referring to the accompanying statement of car detentions during the first 10 months of 1942 on the C. & E. I. your particular attention is called to the figures for hot boxes, which caused about 50 per cent of all delays, most of the hot boxes occurring on foreign and private line cars. A study indicated clearly that unsatisfactory wheel conditions were a contributing factor and we submitted some data to the A.A.R. investigating committee at Chicago, with the result that a committee was appointed to investigate wheel shop practices in and about Chicago.

It was found, for example, that cars of a certain ownership would not operate without serious delays due to hot boxes even though these cars were right out of shop after a repair job costing about \$1,000 and each car was newly painted, stenciled and assigned for loading with a high-class commodity.

Investigation indicated that the wheel shop practices of this car owner were decidedly in violation of all generally-accepted rules. We found wheels mounted from $\frac{1}{8}$ in. to $\frac{5}{16}$ in. out of gage, narrow; one-wear wheels mounted on new axles; wheels condemnable by remount gage on account of high flanges and badly-worn flanges; journals improperly machined; collars on journals $\frac{1}{16}$ in. to $\frac{1}{8}$ in. too high; journals elongated to the extent that they should have been scrapped; and journals on new axles machined either short or long with bad finish on journals, collars and fillets.

The committee visited one road's wheel shop near Chicago and found conditions such as obsolete machinery; a three-jaw boring mill chuck in such condition as to require the use of liners between the wheel rim and the boring mill dogs, the wheels being bored $\frac{1}{4}$ in. eccentric.

* Abstract of a paper presented at the May 10 meeting of the Car Foremen's Association of Chicago. Mr. Fitzgerald is master car builder of the C. & E. I. and chairman of the A. A. R. Chicago Wheel Shop Committee.

By M. E. Fitzgerald

The tools used on the boring mill and the lathe in no way conformed to A. A. R. Wheel Manual requirements and when used would not produce a reasonably good job. The mounting gage was non-A. A. R. standard, too narrow and not conforming to A. A. R. design. No centering device was used, the wheels being positioned on the axles by measuring from the outer edge of the journal collar rather than from the center of the axle.

This is far from being the only shop in the Chicago territory not conforming to A. A. R. Wheel and Axle Manual requirements. We found many others, including large trunk lines, violating the general provisions of A. A. R. requirements. For example, wheel seats are not being properly machined and in many cases it was found that no attention is being paid to the A. A. R. requirement that wheel seats be turned back $\frac{3}{8}$ in. to permit proper measurement behind the wheel hub proper on mounted wheels. We also found journals not being machined where they were tapered and had rough back and front fillets. The facts in this matter are set forth in minutes of the Chicago committee's meeting which are available to all trunk lines in the Chicago territory.

Many Car Wheels Mounted Out of Gage

The committee appointed to investigate wheel shop practices found a number of wheels being mounted out of gage, either due to diagonal bore, eccentric bore, or mounted through the use of worn-out and non-standard mounting gages. A great many of the wheels and axles on hand for use under cars and inspected by this committee should not be permitted to go back into service if we hope to reduce terminal and train delays and the expense incident to wheel and axle defects.

Accuracy of equipment and gages has a major bearing on these practices and this accuracy is largely dependent upon the checking and correcting of the machines and tools in the shop. In connection with lathe and boring mill tools, we found that very few shops are properly equipped to produce proper contour tools. These tools are found to be ground on an emery wheel and put into service. It is the recommendation of the committee that in addition to an emery wheel every shop be provided with a sandstone in water.

In connection with rolls used in rolling journals and fillets, these should be of A. A. R. design and so main-

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tained, and it is further the recommendation of the investigating committee that an arrangement be made whereby these rolls can be occasionally burnished to a fine finish, using an endless leather belt driven by a ¼-hp. motor. This committee felt that after a journal and the seat are turned all particles of steel should be carefully washed off to prevent their being rolled into the finished journal. This is not being done.

Each shop should carefully check boring mills and lathes daily to see that they are in condition to perform proper machining.

Axle Lathes Must Be Checked Periodically

The accuracy of the work being done on the axle lathe can be checked by the boring mill operators who should be instructed to report when any taper or out-of-roundness approaches .002 in. and wheels should not be fitted to any axles which have wheel seats that are in excess of .002 in. The bore of a few finished wheels should also be checked daily, with the same limits for correction. This should preferably be done by the wheel shop foreman. The foreman should also make a habit of observing the pressure diagrams, the finish being obtained in the wheel bores and on the axle wheel seats and journals and should make occasional checks on the roundness of axle journals.

Wheels bored eccentric will cause a vertical movement of the journal with each revolution of the wheel, equal to this eccentricity. The result will be damage to the journal bearings, the car truck, the lading in the car, the rail and to the wheel itself. This condition will never improve in service, but, if anything, will get worse.

Wheels bored diagonally will develop uneven flange wear as well as excessive tread wear, thus influencing the performance of the far truck and causing more lateral movement or nosing due to the wheels not running true with the rail. It will also cause increased bending stresses in the car axle, particularly when the wheels are new.

Wheel bores and axle wheel seats which are machined with a taper or out-of-round cause many misfits in the wheel shop, but more serious than this, they are generally the underlying cause of wheels becoming loose in service. They also result in severe stress concentrations which may contribute to, or be the direct cause of, wheel and axle failures.

Accurate machining is as important in finishing axles as in boring wheels. There are three factors to be considered: The accuracy of the machining as it affects the pressure fit between the axle and wheel; the quality of the finished surface as it may affect the formation of fatigue cracks in service; and the quality of the finished surface of the journal as it may affect journal bearing wear and possible hot boxes.

Axle lathes should be capable of performing precision work. Many axle lathes now in service are not rugged enough to turn wheel seats and journals and withstand the heavy pressures necessary properly to roll journals and seats after turning. Some shops have a special machine for rolling the axles at both ends which makes for a more accurate job. The A. A. R. committee should give serious consideration to recommendations providing that the rolling of journals be performed on such machines.

The wheel seat should be concentric with the journal, round and free from taper, within .002 in. The outer ¾ to ½ in. of the wheel seat should be smoothly tapered approximately ⅓ in. in diameter toward the dust guard seat to aid in starting the wheel straight on the axle without cutting. The journal must be round, having a minimum of taper and rolled to a glass smooth surface.

Use of Micrometer Calipers Recommended

The A. A. R. does not indicate specifically the type of calipers essential for proper measurement of axle and wheel boring operations. This committee investigating shop practices found many shops are using spring calipers and it might be well for the A. A. R. to specify clearly that proper inside and outside micrometer calipers should be used. It is absolutely impossible to get proper measurements using spring-type or even Davis calipers. Outside micrometers should be used in the measurement of wheel seat diameters for the same reason that inside micrometers are required for measuring wheel bores.

There is a tendency in many wheel shops to slight second-hand wheels and axles which are to be remounted. Second-hand wheels should be rebored before being remounted to reduce variables in mounting wheels and eliminate the question of judgment.

It will seldom be necessary to enlarge the original wheel-bore diameter more than ⅓ in. unless it is eccentric with the tread. Where this latter condition is found, shims should never be used to center the old bore under the boring bar. If the bore would otherwise have to be made greater than the maximum, the wheel should be scrapped.

The ideal condition would be to also re-turn all second-hand axles before wheels are again mounted on them. This would eliminate the checking to determine the necessity of re-turning.

Journals should never be re-rolled unless a full machine cut has been taken over the old surface. Attempting to remove imperfections by re-rolling will almost surely cause minute cracks in the hardened surface which may result in trouble later on.

Where it has been decided that re-turning is to be done only on axles which are not perfect, a definite procedure

Analysis of Freight Car Detentions on the C. & E. I. During the First Ten Months of 1942

Cause of delay	System		Foreign		Private Lines		All cars	Time	
	Number of cars	Time, hr. — min.	Number of cars	Time, hr. — min.	Number of cars	Time, hr. — min.		hr. — min.	
Hot box, set out	68	20 20	299	85 27	132	34 47	499	140	34
Hot box, set out	11	2 19	20	3 12	26	4 59	57	10	30
Sticking brakes	33	5 45	54	12 55	63	12 14	150	30	54
Defective knuckle	11	3 43	21	6 39	33	16 54	65	27	16
Defective train line	4	2 15	7	1 36	24	6 43	35	10	34
Defective drawbar	7	5 20	13	7 30	60	50 41	80	63	31
Defective break beam, etc.	10	2 12	48	14 15	29	10 24	87	26	51
Miscellaneous	6	2 15	10	2 28	10	2 42	26	7	25
Defective air hose	4	.. 58	11	2 13	4	.. 58	19	4	9
Train parted	9	2 5	8	1 58	15	2 38	32	6	41
Leaking	0	.. 0	2	.. 27	3	.. 47	5	1	14
Load shifted	0	.. 0	8	1 54	0	.. 0	8	1	54
Close door	0	.. 0	1	.. 10	0	.. 0	1	..	10
Off center	1	1 40	0	.. 0	0	.. 0	1	1	40
Total	164	48 52	502	140 44	399	143 47	1065	333	23

for checking all second-hand axles should be adopted. The wheel seat should not be tapered or out-of-round more than .002 in. as determined by means of outside micrometers; the surface should not show evidence of an uneven bearing from the previous wheel; it should not show evidence of previous machining with a sharp-nose tool, or a feed in excess of $\frac{1}{16}$ in.; there should be no gouges or scratches on the surface; the journal should be round and free from taper; the surface should be smooth, with no rust pits, dents from handling or any evidence of over-heating in service.

In cases where either the journal or wheel seat is to be re-turned, it is advisable to re-machine the other surface as well. If this is not done, there is almost sure to be some eccentricity between these two portions of the axle. It is also preferable, for the same reason, to make the finish cuts on both surfaces without changing the set-up in the lathe. Eccentricity between these surfaces will result in the same objectionable reactions that come from a wheel being bored off center.

Do Not Slight the Second-Hand Axles

The turning of second-hand axles should be done with the same accuracy as new axles. Too much care cannot be exercised, particularly in the fillets. Any sharp or ragged tool marks in these areas of stress concentration can, and often do, form the start of fatigue cracks which may progress to the point of an axle failure and an accident in service.

The use of a journal-truing lathe, or a combination lathe for axle machine work with or without the wheels on the axle, is highly desirable where cut journals in any quantity are re-conditioned. This will permit the refinishing of journals without removing the wheels and will thus greatly reduce the number of second-hand wheels to be refitted. In order to reduce, as far as possible, eccentricity between the newly-finished journal and the wheel seat, the centers of these lathes must be maintained in perfect condition.

A condition frequently arises where mounted wheels and axles are removed from service, generally from cars being scrapped, and re-applied under other cars. These wheels are normally examined for defects and journals frequently re-machined. In addition, they should be checked for axle spacing.

It is recommended that the gage of these wheels be checked in the same manner as second-hand wheels which are being remounted on axles. This should include measurements from the ends of the axle for central spacing of the wheels, and the application of the second-hand wheel mounting gage at three or four points around the wheels to be sure that they are to gage and that the axle has not been bent. Wheel sticks should never be used on axle journals in handling mounted wheels, regardless of the protection on the journals.

The A. A. R. has not yet provided a proper mounting gage for use in connection with the mounting of second-hand wheels. The question is being given consideration as a result of recommendations of the Chicago Wheel Shop Committee, and we hope soon to have provided through the A. A. R. Wheel committee a serviceable second-hand wheel mounting gage. Until such time as that type of gage is provided, this committee would like to suggest that the standard gage have the top opening at the apex of the flange proper blocked off, using a $\frac{3}{8}$ -in. filler block.

Wheels mated on the same axle are required to be of the same tape size. This limits the difference in circumference of mated wheels to $\frac{1}{16}$ in. The gaging of sec-

ond-hand wheels presents a different condition than is encountered with new wheels in that the flanges and treads will have more or less wear. There are three common methods of gaging these wheels on the axles. The preferred method is to use a standard check gage blocked in the opening so that contact is made on the apex of flange instead of on the tread surface.

Recommendations for Submission to the A.A.R.

I should like to recommend that the following be submitted to the A. A. R. Wheel committee for consideration: The wheel seats and journals of all second-hand dismantled axles should be remachined; when a pair of wheels is removed from a car on account of one journal being out, both journals should be remachined, thus eliminating eccentricity; all second-hand wheels should be bored to fit axles; all second-hand pairs of mounted wheels should be gaged with the mounting gage and the spacing of the wheels on axles should be checked before they are applied under cars; rules covering the permissible limits of eccentric and diagonal bores of second-hand mounted wheels should be adopted; a rule covering all misgaged mounted wheels should be adopted; the limit of taper and out-of-round for journals should be specified as a rule; all burrs and sharp corners should be removed from dust collars, end collars and center holes at ends of axle; wheel sticks should not be used on journals or end collars; accurate micrometer calipers should be specified for fitting wheels to axles.

A. A. R. Mechanical Division Releases

Since the last issue of *Railway Mechanical Engineer*, the Association of American Railroads, Mechanical division, has issued a number of circular letters having an important bearing on car department matters and these letters are included, in full or in part, below.

The Sixth Progress Report covering passenger car axle tests with $5\frac{1}{2}$ -in. by 10-in. journals, dated October, 1942, has been completed and is now ready for distribution to members of the division at a cost of \$4.00 per copy and to other than members at a cost of \$8.00 per copy. A small supply of earlier Progress Reports is also available.

Specifications

The Committee on Specifications for Materials has authorized an editorial addition to Table II, page 9, of Specification M-101 by inclusion of the Class F axle, as follows: Class F axle; size of journal, $6\frac{1}{2}$ in. by 12 in.; smooth-forged with rough-turned journal and wheel seats, 1,185 lb; rough-turned all over, 1,200 lb. This will be included in the next revised pages of the A.A.R. Manual.

In response to a demand for revision of Specification M-502 covering relined journal bearings, to provide for relining the present standard emergency bearing, the Committee on Journal Bearing Development with the cooperation of the Committee on Specifications for Materials has approved a revision covering the relining of both the A.A.R. Pre-War and Emergency journal bearings, harmonizing as far as practical, crown and lining thicknesses in the interest of conservation of critical and scarce materials. This revision was issued in the last set of revised pages in March-1943 as Specification EM-502-42 and fully covers the general relining practice which should be followed.

Wheel Designating Letters Must Be Shown

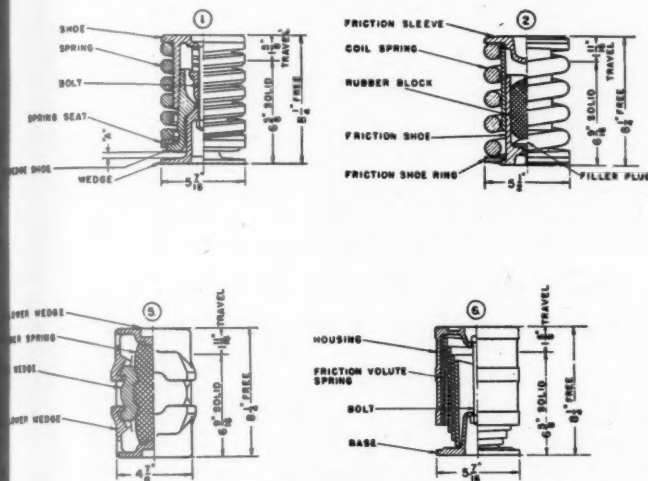
Effective January 1, 1942, Specification M-403 covering cast-iron wheels was modified to eliminate the purchaser's initials and, in lieu thereof, the manufacturer is now required to number his wheels consecutively, using a letter prefix to indicate the plant designation. Difficulties are being experienced with respect to identification of failed wheels from evidence appearing on A.A.R. billing repair cards, due to the fact the letter preceding the serial number is not shown.

It should be understood that the designating letter is intended to become a part of the serial number and should

be shown in a manner and where this lettering is worn badly and still difficult to read, it should be renewed.

Applying Snubber Springs

Because of complaints received from tank car owners that snubber springs were being applied upside down and in the wrong locations in spring nests, the A. A. R. Mechanical Division on May 15 issued standard instructions to be followed by all roads when applying snubber springs. Application prints used by the Union Tank Car Company were used to show the proper methods of application and maintenance of the various snubbers.

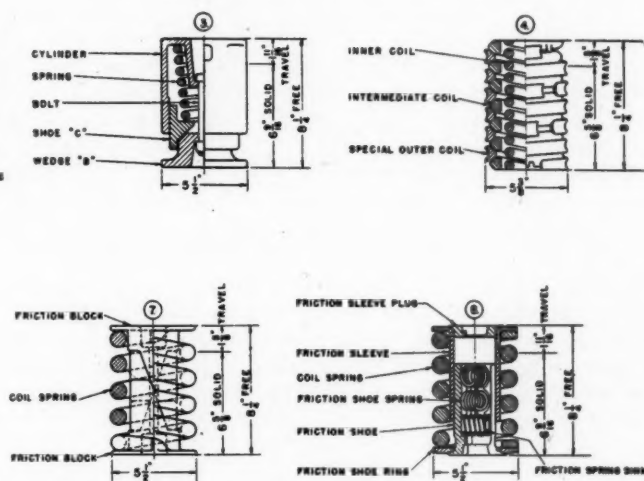


CARDWELL TYPE A—This snubber consists of a coil spring, spring seat, wedge, shoe and a bolt tying the entire unit together. To determine if the snubber has full capacity or replacement of parts is necessary measure the distance *A* between lower shoe and wedge flange. If this dimension is $\frac{3}{16}$ in. or less the friction parts in the snubber have worn and repairs are necessary. The snubber must be applied with marking "this end up" at top.

SYMINGTON-GOULD SBR—This snubber consists of a coil spring, filler plug, rubber block, friction sleeve, friction shoe and shoe ring, held together by a radial pressure of 250 lb. per sq. in. on rubber block. If there is a looseness of shoes in the sleeve this will indicate the friction parts in the snubber have worn and repairs are necessary. The snubber must be applied with marking "this end up" at top.

MINER C-2XB—This snubber consists of a coil spring, wedge, three shoes and a cylinder all tied together by a bolt. In case of spring failure, the friction elements consisting of wedge *B* and three shoes *C* would become loose and repairs are necessary. The snubber must be applied with marking *B* at bottom and with marking "top" at top.

FROST 360—This snubber consists of a standard A.A.R. inner coil, one intermediate coil and three-piece special outer coil. As long as the three-piece outer coil is tight upon the intermediate coil with the spring in the car under light weight, or any load, the snubber is still functioning. This snubber is symmetrical and may be applied with either end



5—AMERICAN STEEL FOUNDRIES SIMPLEX UNIT—This snubber consists of two interchangeable follower wedges, two side wedges and rubber spring. Snubber is held together by uniformly distributed pressure created by rubber spring and interlocking of side and follower wedges. When the ends of the follower wedge wearing surfaces are worn to a knife edge it will indicate the friction parts in the snubber have worn and repairs are necessary. This snubber is symmetrical and may be applied with either end up.

6—HOLLAND A-6—This snubber consists of one working part, a friction volute spring which can be inspected without dismantling the unit. The housing and base which constitute the remaining parts are primarily spring seats for the friction volute spring, a bolt tying the entire unit together. When the volute spring is broken or when snubber appears to be loose in the spring group because of insufficient free height, repairs are necessary. The snubber must be applied with marking "this end up" at top.

7—GUSTIN-BACON A-1—This snubber consists of one coil spring and two identical forgings or friction blocks. When the spring or either forging is broken or when the spring has taken excessive set, repairs are necessary. This snubber is symmetrical and may be applied with either end up.

8—SYMINGTON-GOULD SBS—This snubber consists of a coil spring, friction sleeve, friction sleeve plug, friction shoe ring, three friction shoes, three friction shoe springs and three friction spring shims. If there is found a looseness of shoes in the sleeve, this will indicate the friction shoes in the snubber are worn or friction springs defective and repairs are necessary. Snubber must be applied with marking "this end up" at top.

Various snubber designs involve differences in application and repair

appear on all wheel records. Car department supervisors are requested to see that this essential information is recorded on wheel records and billing repair cards.

Tank Car Lettering Illegible

Numerous complaints are being received calling attention to the fact that essential lettering on tank cars, including reporting marks and car numbers, is being obliterated by oil and dirt. It is essential that this lettering be kept legible for the benefit of railroad and refinery employees in order to avoid errors in billing, etc.

In cases where it is necessary to renew stenciling, Items 39-241, inclusive, of Interchange Rule 107, provide allowances for renewing this stenciling to preserve the identity of cars. In the case of tank cars, all that is required in many cases is to wash the accumulation of oil and dirt from this essential lettering. All car owners and lessees are urged to institute a program of cleaning their cars when the lettering has been obscured in this

The required locations for snubbers were identified as the outside right corner on trucks with four spring clusters to the group, center of the cluster on five-spring nests, and outside on the center line of the truck in six-spring nests.

Air Brake

Questions and Answers

HSC High-Speed Passenger Brake Equipment

186—Q.—Describe the operation when the speed exceeds approximately 69 m. p. h. **A.**—When the speed exceeds approximately 69 m. p. h., there is sufficient voltage developed in the generator to cause relay 2-H to assume the energized position. The closing of contact 2-HA completes the circuit from register 9 through the

lower coil of relay *L* and contact *2-HA* to the negative side of the battery. Thus relay 6 again assumes the energized position. Contact *6-E* being closed, battery current will flow through contacts *6-ME* to *6-E* to the high-speed magnet *H* of the *FS-1864* relay valve. With both the medium and high-speed magnets of the *FS-1864* relay valve thus energized, 100 per cent maximum braking force is developed. Induced voltage in the upper coil of relay 6 assists in positively closing the contact of relay *2-H* as described previously. The transfer contact *6-MA* has now functioned to insure that the induced voltages from relay 6 will now act on relay *2-H* rather than on relay *2-L* as occurred at the lower speed.

187—*Q.—What happens when running at high speed and a brake application reduces the speed below 65 m. p. h.?* A.—The reduced current flowing through the coil of relay *2-H* causes it to assume the de-energized position, thus opening contact *2-HA*. This de-energizes relay 6, thus opening contact *6-E* and de-energizing the high-speed magnet *H* of the *FS-1864* relay valve. Thus only the medium speed magnet *M* is energized and 80 per cent maximum braking force is developed.

188—*Q.—Describe the action when the speed reduces to approximately 40 m. p. h.* A.—Relay *2-M* becomes de-energized, its contact *2-MA* opening the circuit of relay *6-M*, which relay in turn becomes de-energized and the opening of contact *6-ME* de-energizes the medium speed magnet *M*, thus developing 60 percent maximum braking force.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Railroad Initials Not Basis For Claim of Wrong Wheels Applied

On December 13, 1939, the Railway Express Agency submitted to the Atlantic Coast Line a joint inspection certificate dated July 31, 1939, covering wrong size wheels bearing A. C. L. markings found under R. E. X. car No. 141 for which no billing repair card had been received. Second-hand multiple-wear wrought-steel wheels of 36 in. diameter had been found under the car instead of 33-in. wheels which were standard. Joint evidence of wrong repairs was taken on July 19, 1939, and a check of the Express Agency's records and billing repair cards failed to disclose anything covering the application of the wheels in question. The last record of application of wheels in the particular location was one of April 13, 1938, showing the application of new 33-in. wheels by another road. The contention of the Express Agency was that, inasmuch as the car had been in service on two separate occasions on the A. C. L. and no other railroads or terminal companies which had had the car in their possession between April 13, 1938, and July 5, 1939, had any record of the wheel exchange, the wheels must have been applied by the A. C. L. Reimbursement was also claimed for the difference in value between the wheels removed and those

applied. The A. C. L. returned the joint inspection certificate, claiming no record and further disclaimed any responsibility unless the Railway Express Agency could produce an A. C. L. billing repair card. Since no such card was produced the A. C. L. cited Rule 13 and also claimed that its position was in accord with the decision rendered in Cases 1178 and 1244.

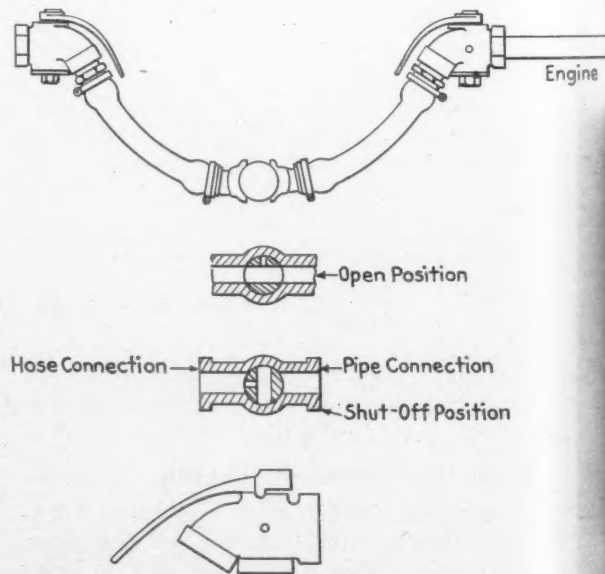
In a decision rendered November 6, 1941, the Arbitration Committee ruled that: "A thorough investigation on the Atlantic Coast Line failed to disclose the wheels involved were applied to R. E. X. Car 141 on that line; neither has the car owner furnished proof the wheels involved were applied by the Atlantic Coast Line. Railroad initials being on wheels, especially second hand cannot be accepted as evidence the wheels were applied by such road. Therefore, the contention of the car owner is not sustained. Cases 1129, 1178 and 1244 are parallel in principle."—*Case No. 1786, Railway Express Agency Inc. versus Atlantic Coast Line.*

Bleeding Hose When Uncoupling Locomotives

By P. J. Hogan

Angle cocks modified by the drilling of a small port in the angle cock body permit the bleeding of air hose before engines are uncoupled from a charged car. Air pressure in the hose is relieved even though angle cocks on the locomotive and car are closed.

At the present time air hose are usually separated under pressure by car inspectors or engine crew members. This causes a strain and, in many cases, the



Pressure in air hose is relieved by the use of a modified angle cock

man performing the operation hasn't the necessary strength or knack for uncoupling the hose and allowing them to pull apart with the pressure in them. The modification suggested pays dividends in the elimination of ruptured hose losses, leaking or broken brake pipes and occasional personal injuries.

*Supervisor car inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.



Mrs. Pauline Schafer packs journal boxes
in Southern Pacific yard at Portland Ore.

Women Workers in the Car Department

Miss Julia Orosz keeps fiery
rivets flying for two or three
teams of riveters at Glenwood,
Pa., shops of the Baltimore &
Ohio

P-G photo by Klingensmith



Operating a pipe-threading ma-
chine in the shops of the Penn-
sylvania at Wilmington, Del.



Mrs. Hazel Edenbrandt operating
nut-tapping machine in Southern
Pacific shop at Portland, Ore.



ELECTRICAL SECTION . .

Vitamins For Diesel Power

Part I

By **Walter H. Smith***
and
A. H. Candee*

THE purchase of Diesel motive power by the railroads of America has been limited to some extent by two factors—a rather definite maximum horsepower output from any specific engine and a relatively high investment expense per horsepower delivered at the rims of the driving wheels. These two factors are of special importance when the characteristics of steam and Diesel motive power are compared, since the steam locomotive is usually somewhat lower in first cost, has a relatively high power output over a fairly wide range of operating speed, and has some short-time overload capacity provided by the stored heat in the steam generating system. It becomes important, therefore, for the designer and manufacturer of Diesel motive power to insure the greatest utilization of the potential power capacity of each Diesel engine.

An internal combustion engine has a definite maximum horsepower output, and the need for automatic limitation of the engine loading to that available was recognized early in the development of automotive railroad power. Systems of control which relied upon the engineman's judgment to utilize the engine's full output most effectively without exceeding the engine's capabilities were found to be unsatisfactory. This still applies to motive power with mechanical systems of transmission (change gears and clutches) where mishandling can easily place severe stresses on, and seriously increase the repair expense of the engine and the drive equipment. The success of the Diesel engine for modern railroad motive power has been due, to a great extent, to the application of automatic load limiting characteristics built into the transmission system.

Electrical drive has proved, so far, to be the most practical method of transmitting the power from a Diesel engine to the drive wheels of a locomotive or railcar. For this reason, most of the Diesel motive power units employ this system, and since one of the component units of such a drive is an electrical generator driven by the engine, the designing engineer has an excellent opportunity to control the engine loading by automatic regulation of the generator voltage. The need for load limitation is because when an internal combustion engine is operated beyond conservative limits of speed or power trouble inevitably results or maintenance expense is unreasonably high. The use of automatic load control arises from the necessity of relieving the engineman of responsibility for the correct engine loading, so that he may direct his attention to the more important duties of train movement.

Full power of a Diesel engine is normally obtained with the engine operating at its full speed, both the full operating speed and the maximum continuous power output being set by the designer in accordance with conservative results obtained from actual operation.

* Both Mr. Smith and Mr. Candee hold the position of transportation engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Comparison of several types of control used to obtain best engine performance

However, this engine power, converted into electrical energy by a generator, may be utilized at various combinations of voltage and current. As an example of this, take the case of a Diesel engine delivering its full output of 1,000 horsepower for the operation of a switching locomotive. Since some power must be utilized for driving such auxiliary devices on the locomotive as air compressors and cooling fans (usually about 50 to 80 hp. maximum), assume that only 920 hp. will be available for conversion by the main generator into propulsion power. Expressing this horsepower in electrical terms (1 hp. = 746 watts), 920 hp. is 686,320 watts. Since one watt is one volt multiplied by one ampere, this power may be expressed as 1,000 volts and 686 amperes, 900 volts and 762 amperes, and so on down to 200 volts and 3,431 amperes. The full available engine power (920 hp.) then, may be plotted in electrical terms as shown by curve A of Fig. 1. Now, since there is some slight loss in this conversion from mechanical to electrical power, the horsepower which may be taken out of the generator is slightly less than 920 hp. and is in accordance with curve B of Fig. 1. The reason that it is necessary to vary the voltage and current at which this electrical power is utilized is to obtain variable speed-tractive force characteristics, since train speed tends to vary in accordance with the voltage applied to the traction motors and tractive force varies with the current flowing through the motors. Three relative speed points are shown on the curve.

Curve B of Fig. 1 indicates the generator output voltage-ampere relation which must be maintained if the Diesel engine is to be kept fully loaded and yet not overloaded. While such a characteristic can be secured in locomotive operation by manually adjusting the generator field strength (thus varying the voltage) in accordance with the output current variation, this entails far too much attention by the engineer and the obvious solution is to include self-regulating features in the generating equipment to produce this form of curve.

One of the earliest attempts to minimize the overloading of an internal combustion engine as applied for rail propulsion purposes was the use of a differentially connected series field (a reversed field which car-

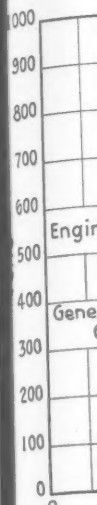
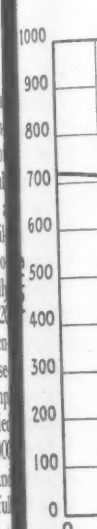


Fig. 1-



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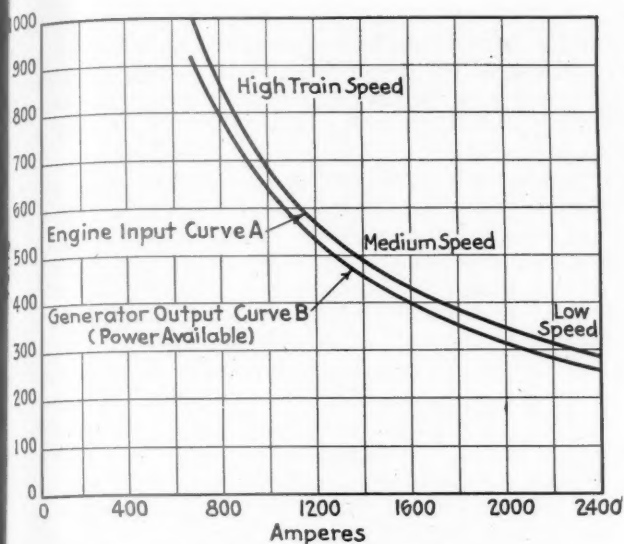


Fig. 1—Volt-ampere variation for constant horsepower—Engine hp. 920

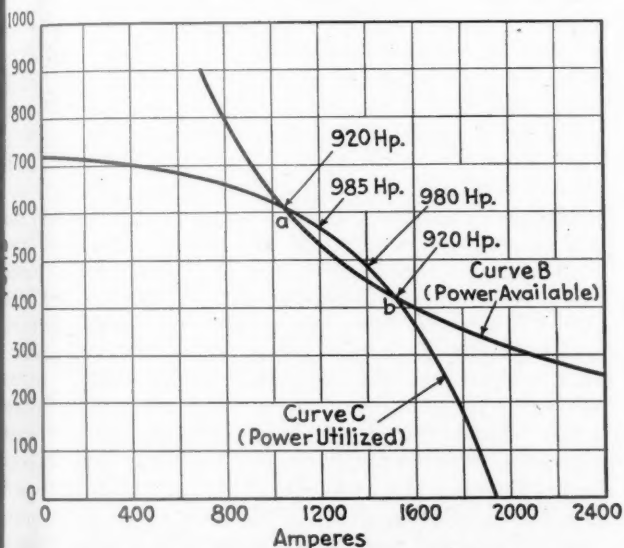


Fig. 2—Early version of automatic regulation

ies the output current) wound into a gas-electric rail-generator. While the characteristics of such a device were far from being ideal, it gave recognition to the need for automatic limitation of the power which could be demanded from the engine. The shape of the output curve with such a differential series field was entirely wrong, since the curve was convex (bending outward), whereas curve *B* of Fig. 1 shows clearly that a concave curve (bending inward) is necessary. Curve *C* of Fig. 2 shows the approximate volt-ampere output of a generator with a normal (differentially wound) series field, the portion of this curve between *a* and *b* representing the zone where the generator will attempt to take more power than the engine can deliver (which results in over-loading and pulling down its speed). The engine is underloaded elsewhere along this curve.

In 1925 a fundamental development occurred which has had a great influence on the success of gasoline and Diesel-electric motive power. This was the differential field exciter devised by Westinghouse,* wherein the differential field carrying the generator output current was transferred from the main generator to the

exciting machine and the exciter output characteristic curve was made concave. With such an exciter characteristic curve the main generator curve was also concave, which conforms much more closely to the desired values. The inherent output characteristic of a main generator when excited by the modern version of such an exciter is shown by curve *D* of Fig. 3. The simple electrical connections for this differential exciter method of control are shown schematically by Fig. 4.

A differential series field winding, carrying main generator output current, normally causes a convex generator voltage characteristic when applied to either

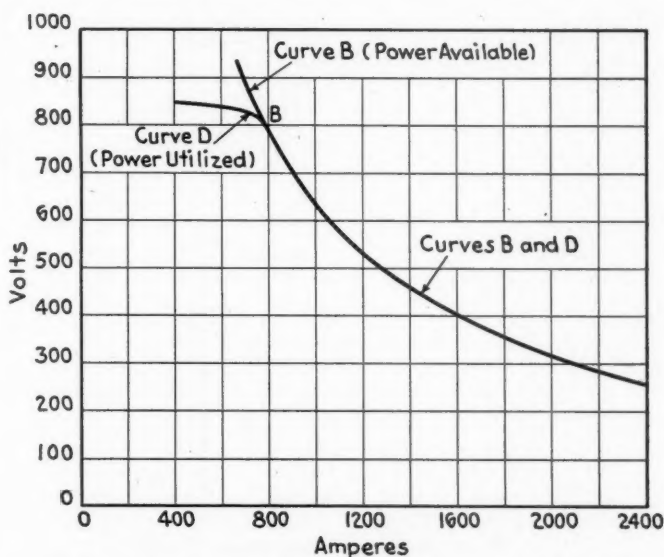


Fig. 3—Main generator characteristic with modern differential field control

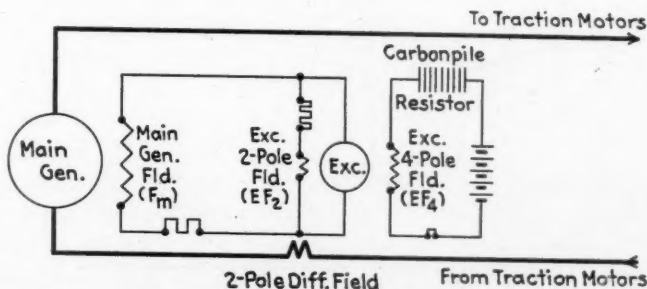


Fig. 4—Schematic wiring diagram for differential field control

the main generator or to its exciter, as shown by curve *C* of Fig. 2. The unique feature of the differential control exciter is the method of generating a concave curve by means of the series differential field action. This result is accomplished by generating cumulative or opposing voltages in the exciter armature conductors by means of two separate groups of field poles. Both the original Westinghouse exciter (Patent 1,730,340) and the modern machine are of six-pole construction, four poles of which are battery excited and generate a relatively constant voltage, to which is added or subtracted the voltage generated by the two additional poles, each carrying self-excited windings (in the latest designs) and differential field coils. These latter poles have reduced cross sections so that they will saturate magnetically.

Fig. 5 shows the arrangement of exciter windings. If the voltage generated in the armature by field poles No. 1, No. 2, No. 4, and No. 5 is considered alone, this is approximately a straight line, as long as the

* See original Gerald F. Smith patent No. 1,730,340 and subsequent improvements as shown by patents No. 2,157,869 and No. 2,217,499 assigned to Westinghouse.

engine speed does not change. This is shown by curve E of Fig. 6. The voltage generated by the two poles No. 3 and No. 6 varies considerably depending upon

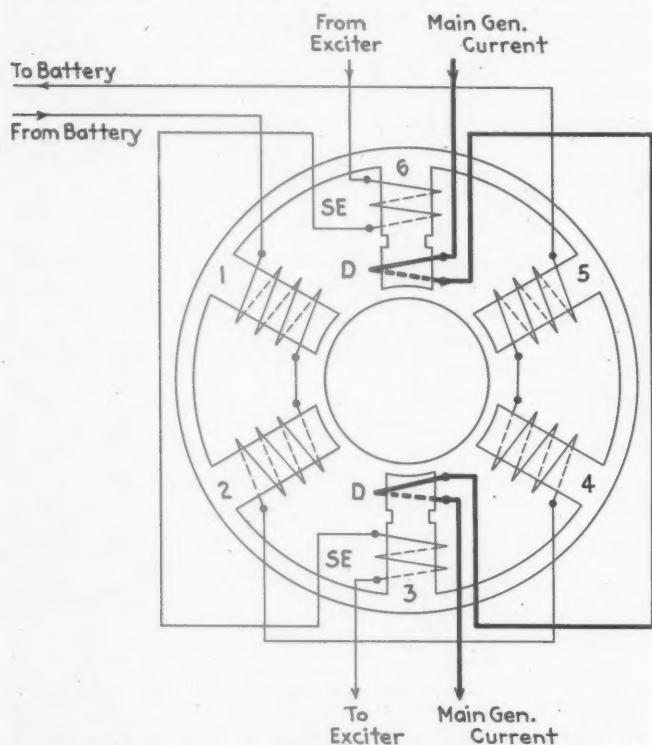


Fig. 5—Differential field exciter circuits

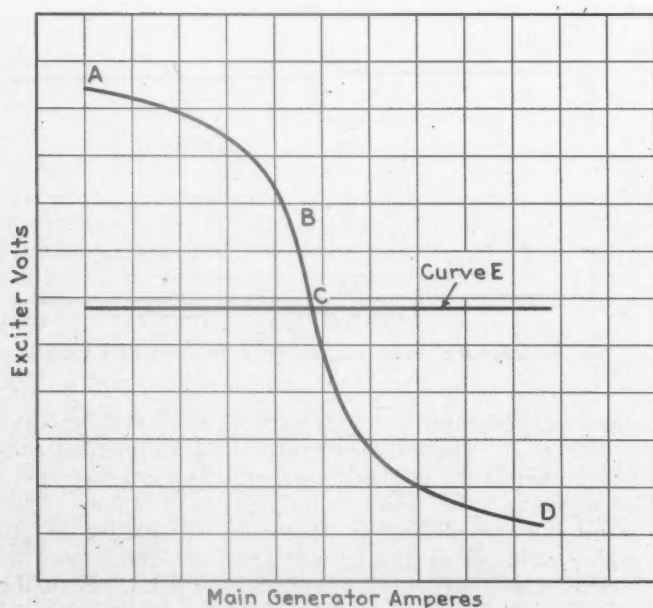


Fig. 6—Differential field exciter characteristic

the relative strengths of the self-excited field and the main circuit differential field. Thus, with no main generator output current flowing through the differential field, all of the voltage generated by the self-excited windings is added to that of the four poles (Nos. 1, 2, 4, and 5) to give a voltage as at A. Another point on the resultant curve is C, where the differential field and the self-excited field neutralize each other, thus causing the effective voltage to be that of the four poles. Beyond this point, the differential field overcomes the self-excited field and thus sub-

tracts from the four pole voltage, at a D. The bending of the curve from C to A and from C to D is caused by the magnetic saturation of the two poles No. 3 and No. 6. The net result is that the portion of the curve from B to D is concave in shape and the characteristic is transmitted from the exciter to the main generator. The sharp knee of the curve shown at C in Fig. 3 is obtained by some compounding of the exciter and other design refinements not shown in this simple schematic diagram, Fig. 4.

To those not familiar with the limitations of differential field control, the question may arise as to whether it is necessary or desirable further to improve automatic engine loading methods, since this system appears to fulfill the requirements completely in a very simple manner. The characteristic shown by curve D of Fig. 3, however, is obtainable only at a definite temperature of the generating units and as the equipment temperature is lowered, the curve rises to try to take more than normal power from the engine. Reference to the diagram (Fig. 4) shows why this is the case. Since the resistance of a field winding gets lower as its temperature goes down, it may be noted that more than normal current will flow from the battery to the exciter field EF_4 , which tends to cause higher exciter voltage than normal. This effect becomes cumulative, since the higher exciter voltage and the lower resistance of the self-excited field, EF_2 , tends to raise the exciter voltage still higher. Further cumulative effect is noted in the main generator voltage since higher exciter voltage impressed on the cold field of the generator causes considerable excess in main generator field current and thus overvoltage relative to the main current output. Moreover, for any equipment temperature the main generator output characteristic is inflexible, so that even when the temperature is correct to take normal full load from the engine, the speed may be pulled down due to the engine's inability to develop full power from whatever cause, such as dirty injectors, valve leakage, ring leakage, high air temperatures, or elevation above sea level. The reverse is true, of course, and the engine will be underloaded if the electric equipment is operated at a temperature greater than that for which the loading is set or if the engine has excess power available. Thus, if the differential field controls loading is set to take, say, 920 hp. from a 1,000 hp. engine (net after auxiliary power is deducted from 1,000 hp. engine), there is no way to utilize this excess 80 hp. when the auxiliaries are not operating. Since overloading greatly increases engine maintenance expense and underloading is a waste of expensive power equipment, the application of an additional load regulating device is an economic improvement, especially when it is simple and automatic in its operation.

As stated before, the need for close automatic regulation of the power demanded from an engine to conform to its capabilities, has long been recognized and many schemes have been employed to accomplish this result. Among these have been:

Differential field control.

Motor driven faceplate rheostat connected to vary the main generator field strength and actuated by contacts on the engine governor.

Faceplate rheostat actuated by pressure oil from an oil operated governor.

Torque control.

Governor operated gas-filled tubes for field regulation.

Governor responsive carbonpile field regulation.

Autoload control.

It is the latter system which is now providing the means to insure maximum Diesel power utilization without danger of excess maintenance expense.

There are three general qualifications which any automatic engine load regulating system must have if it is to be successful for railroad motive power. These are simplicity; accurate engine loading, and freedom from hunting. With the exception of Autoload control all systems which have been used so far have been imperfect in one or more of the required qualifications. Differential field control has poor loading characteristics: Faceplate control, whether motor or electrically driven, is slow in response and normally causes hunting or hunting. Torque control results in accurate loading but requires an additional rotating machine (a pilot generator). Other schemes have similar defects. In designing an effective system of load control for Diesel-electric motive power, it is necessary to start with some engine characteristic which reflects the loading conditions of the engine. One basic function which changes or tends to change as the engine load varies is engine speed, which normally rises as the machine becomes unloaded or falls when overloaded. In torque control, the voltage of the pilot generator varies as the engine speed, and this voltage furnishes the actuating force to govern the regulation. In most of the other systems, including Autoload control, the action of the speed governor is used to indicate engine speed variations which reflect engine load conditions. When an engine becomes overloaded, its speed decreases slightly and the governor tries to give the engine more and more fuel.

Since the maximum has been predetermined, excess governor movement has no effect in increasing the fuel input, but may be used for actuating the electrical regulating system to reduce load. Conversely, as the engine speed tends to rise (thereby indicating engine unloading) the governor acts on the regulating system to build up the load to the maximum possible before the fuel input is reduced. [The Autoload control will be described in the next issue.]

Car Lighting Without Fixtures

When it became necessary recently for the Norfolk & Western to redecorate a number of diners, the lighting fixtures were removed and not replaced. In their stead, frosted glass, replacing wood panels, were placed in the decks and on either side of the clerestory. Behind each of these panels is a 48-in., 40-watt, T-12 fluorescent lamp. There are 20 of these lamps in the dining section. Behind each lamp is a metal white-enameled reflector and the space required by this reflector on the outside of the car on either side of the clerestory is covered by a metal housing. Illumination intensities on the table tops are about 22 foot-candles.

This car is equipped with a 110-volt, d.c. power system including a 20-kw. generator and a 300-amp. hr. storage battery. The type of fluorescent lamps used are normally operated with the necessary auxiliaries from a 220-volt, 60-cycle a.c. power supply, but in this case they are operated ten in series from a 5,000-volt (open-circuit), power source.

The high-voltage power for the fluorescent lamp is obtained by means of a 1.5-kw. booster-type rotary converter. This machine was originally made to supply power to Syntron hammers and has a special winding which causes the a.c. output voltage to be 110, the same as the input voltage. Thus, having 110-volt, a.c. power available, it was possible to install a standard 360-milliamperes, sign-lighting transformer to supply the necessary high voltage for operating the lamps ten in series cold cathode. The normal current rating for the lamps is 420 milliamperes, so that the lamps operate slightly below their rated capacity.

An interesting point in the operation of the lamps is that they all light instantly when power is connected to the d.c. end of the converter. In other words, the lamps light at zero frequency but do not go out again since the speed of the converter rises rapidly to its normal 60 cycles at full speed.



The redecorated Norfolk & Western diners have frosted glass panels lighted by cold-cathode fluorescent lamps

Four Ways To Conserve Cable

By George M. Rogers*

Railroads and other users of motor-lead cables have had to wait months for delivery of motor-lead cables from the manufacturers. One way to avoid resulting delays to repair work is to salvage old leads. The accompanying sketches show four ways of doing this.

The left hand sketch in Fig. 1 shows two main field coils from a 250-hp., 750-volt traction motor as usually connected. The two motor leads extend from the rear

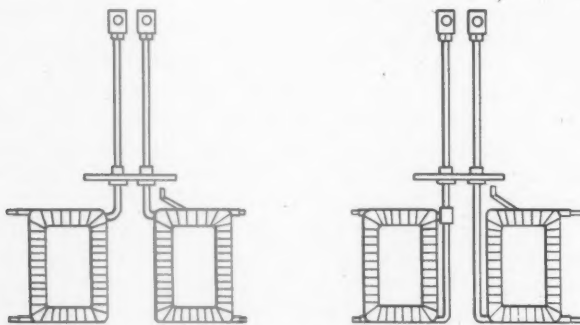


Fig. 1—The change in traction motor field leads as shown reduces length of lead wire and does not change motor speed

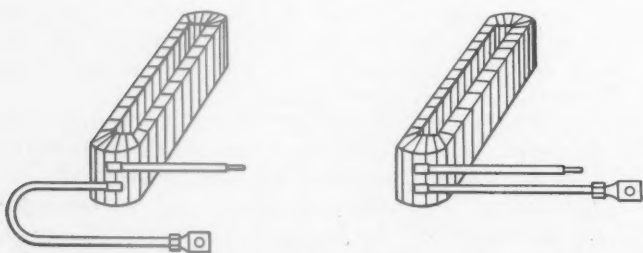


Fig. 2—Avoiding loops in leads to brush connections shortens the cable required

of the field coils, going to the front of the motor and then to the line. The right hand sketch shows the same two field coils with the two motor leads connected to the same two circuits as before, but the leads now come out the front of the coil. By effecting this simple change, it is possible to save about 6 or 7 ft. of cable per motor. A test motor on which this change has been made has been running over a year with satisfactory results.

At the time the alteration was being made, several persons offered divergent opinions as to how it would perform. Some said it would "heat up," while others declared it would "speed up." However, upon running this motor with three others on an hour's test in the shop, the speed of all four of the motors was about the same.

Figure 2 also shows two field coils from a traction motor. The field at the left has one lead with a turn in the cable made to reach the brush holder. The leads can be brought out in the same direction as shown at the right. In some instances, this operation will save two or more feet of lead cable on one motor.

Many minor cracks in motor-lead cable can be sealed with Minerlac, or some other flexible insulating sealing compound, with the aid of a hot sealing iron. Figure 3 shows a heating iron as used for sealing the cracks in a

piece of cable. The iron can be made conveniently from a brass bushing $1\frac{3}{4}$ in. in diameter and 2 in. long with hole $1\frac{1}{8}$ in. bored through the center of the bushing.

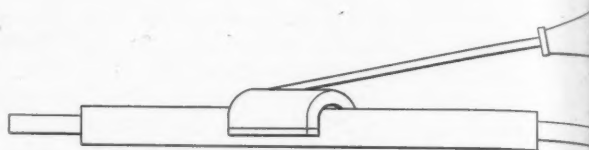


Fig. 3—A shop-made sealing iron as used for sealing cracks in cable

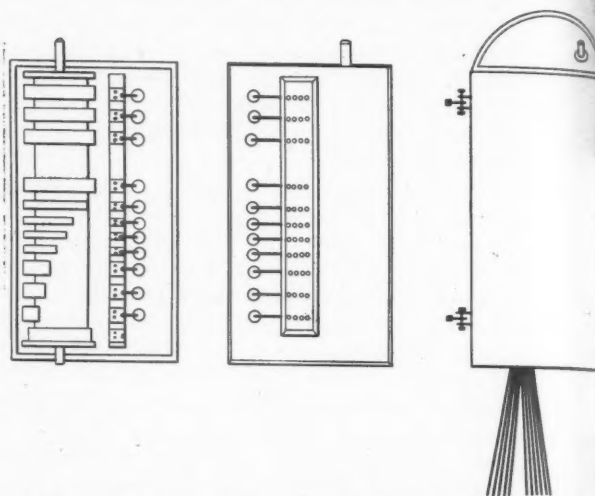


Fig. 4—Three views of a type K or R ground controller showing how leads may be brought out the back of the case instead of in the front of long cable leads out of the bottom

The bushing is cut in half and to one of the halves is welded a piece of $\frac{1}{4}$ -in. brass or iron rod 8 in. long as shown. A wooden handle on the other end of the rod protects the user's hand. Sharp edges should be filed from areas where the iron makes contact with the cable.

A type K or R controller such as are used in many railroad shops to operate traveling cranes, jib cranes, turntables, and transfer tables is shown in Fig. 4. In these controllers each wire is soldered in a finger base. The wires always run out the bottom of the controller and under the crane cage and then up to the motor. When trouble develops and the controller goes to the shop for repairs, the electrician usually splits the connection under the crane cage; thus when the controller goes to the shop it has lengths of wire coming from each finger base; wire which is usually replaced with new.

With the connector block on the back of the controller it is possible for the electrician to disconnect the controller and at the same time leave the wires on the crane without throwing them away.

* * *



* Armature winder, Illinois Central.

CONSULTING DEPARTMENT

Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York.

The rubber situation, the heavy passenger traffic and the shortage of maintenance forces have made a new problem out of an old one. What under the circumstances can be done to preserve and improve the life of flat axle generator belts?

equipment when cars are in service in trains. This educational program can be carried out by means of bulletins or circular letters and, if necessary, instruction classes. One of the most effective types of bulletins is a printed notice on or near the air-conditioning panels of each car.

Air filters, like other materials, are hard to procure under the war program, and filters used in return air grills can be removed entirely on a great number of cars. In such cars a removable frame covered with a fine mesh screen would serve the purpose of preventing a large portion of lint and dust from collecting on the coils of the evaporator or the overhead heating unit.

The periodic cleaning period should be at least every thirty days, unless operating conditions and territory prove that it can be extended.

JOHN V. DOBBS,
Car lighting and air-conditioning inspector,
Atchison, Topeka & Santa Fe,
Albuquerque, N. M.

Inspect More Frequently

Any air-conditioning system depends upon air circulation within the area to be conditioned, and if the air is to be properly conditioned, it must be clean and free of objectionable odors. This end cannot be accomplished if the recirculated air filters are clogged or dirty to the extent that proper movement of the air through them is retarded, or if the fresh air filters are so clogged that a sufficient quantity of fresh air is not admitted to the plenum chamber for mixing with the return air to replenish oxygen, dispel odors, etc.

Therefore, to achieve the best possible performance of the air-conditioning equipment as a whole, there is only one suggestion that can be made for getting "the best possible performance out of the air-conditioning filters," and that is *Keep them clean*.

In view of present-day operating conditions with frequent delayed train schedules, quick doubling and turn-arounds of equipment, extra trains and cars, etc., it just means that closer attention and more frequent inspections and cleaning of these filters will be necessary if desired results are to be obtained. This cannot be impressed too strongly on the maintenance forces, and the rule applies with equal force to the evaporators, cooling coils and condensers—in fact, any part of the systems involving the free passage of air.

W. J. DAWSON,
Kansas City Terminal Company,
Kansas City, Mo.

Air Filters

What can I do to get the best service and longest life from the evaporator and condensers in our air-conditioned cars?

Geography Often Controls Methods

The question of performance of air filters with reference to periodic cleaning and proper air filtration is one of long standing. The governing factors are type of service and geographical territory through which the cars are operated, plus the type of locomotive used in handling the train. Where electric, Diesel or oil burning locomotives are used there are no cinders; on the other hand, if in the Southwest where sand and a great amount of dust is encountered, the cleaning period must be of shorter length.

It is my understanding that on a number of railroads the procedure followed in cleaning filters is to use a high-lift type gun with cleaning solution or to boil them in a vat of such solution, allow the filters to dry, then dip in a vat or tank of hot oil and allow to drain. This procedure consumes considerable time and labor, both of which are vital under existing conditions. I have found by blowing filters, that is, those of the expanded metal or wire mesh type, with high-pressure air, steaming them with live steam and blowing with air to dry, and then by using one of many types of spray guns, the oil can be applied in such a manner as to impregnate the filter properly without an excessive amount of oil. On a car using three filters, the total time required for the removal, cleaning and reapplication of filters consumes only about an hour or one man. If extra filters are available, this time can be reduced.

If it is felt that such a procedure does not clean the filters to a fine degree, then the high-lift gun cleaning could be used, say, twice a year.

One thing often overlooked on cars using a filter in the return air grill or in the plenum chamber to filter both outside and return air is, that if both cars are swept while the air-circulating fan is running, the lint and dust raised is drawn directly into the filter, and in a short time the air-flow through such filters is restricted to a point where it reduces the cooling capacity of the car.

This feature can only be overcome by a vigorous program of education of all employees who operate the



Women in the Electrical Department



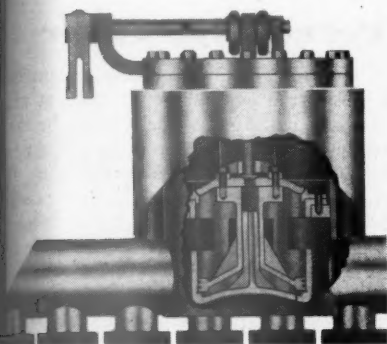
Upper left—Pennsylvania woman worker grinds armature slots preparatory to re-winding. Upper right—An electric locomotive switch being assembled in the Pennsylvania's Wilmington, Del., shops. Lower left—Dirt is removed from a multiple-unit car switch group on the Illinois Central. Lower right—A woman tests locomotive pantograph pressure on the Pennsylvania



NEW DEVICES

Compact Headers Save Front-End Space

Designed to provide a continuous down-ward flow of steam from its entrance into a dry pipe through the headers and units of the cylinders, the C-S superheater, unit has been developed by the J. S. Coffey Co., Company, Englewood, N. J. The system is substantially self-draining and free from intricate cored passages and pipe



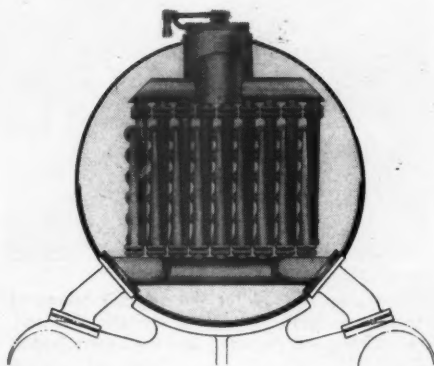
The C-S throttle valve with the top header integral

ends. Steam travels but once in each direction through the units. The units are designed without internal or external obstructions. The self-draining arrangement makes it unnecessary to blow them out after a hydrostatic test has been made; the opening of the cylinder cocks drains the system. This feature reduces to a minimum the accumulation of scale deposits due to priming or carry-over.

The compact arrangement of the headers results in a saving in front end space

which can be utilized to increase the length of tubes and flues, thus adding to the evaporative capacity. Light weight design permits this additional heating surface without increase in total weight.

The units have 77 per cent of their surface subject to counter-flow heat transfer from gas to steam which results in a high rate of heat transfer per square foot of surface. This, combined with a greater heating surface per foot of unit length, gives maximum superheat temperatures. All units for a given class of locomotive are identical and interchangeable. The same design is also standard and interchangeable on all classes having large flues of the same length. The manifolds on the ends of the unit are of heat-resisting forged steel, without bends or machined joints.



Front-end view of superheater and throttle valve

The diagrammatic arrangement shown includes the C-S throttle, front-end type, which is located in the smoke box and is

integral with the saturated steam top header. This method of front-end throttling is made possible with units of this type because of the self-draining feature and affords protection in the event of burst superheater tubing by controlling the steam at this point.

The design of these units provides for a pressure drop which is intended and necessary for the protection of superheater units against over-heating. This pressure drop is a maximum of 10 lb. when a locomotive is operating at design capacity.

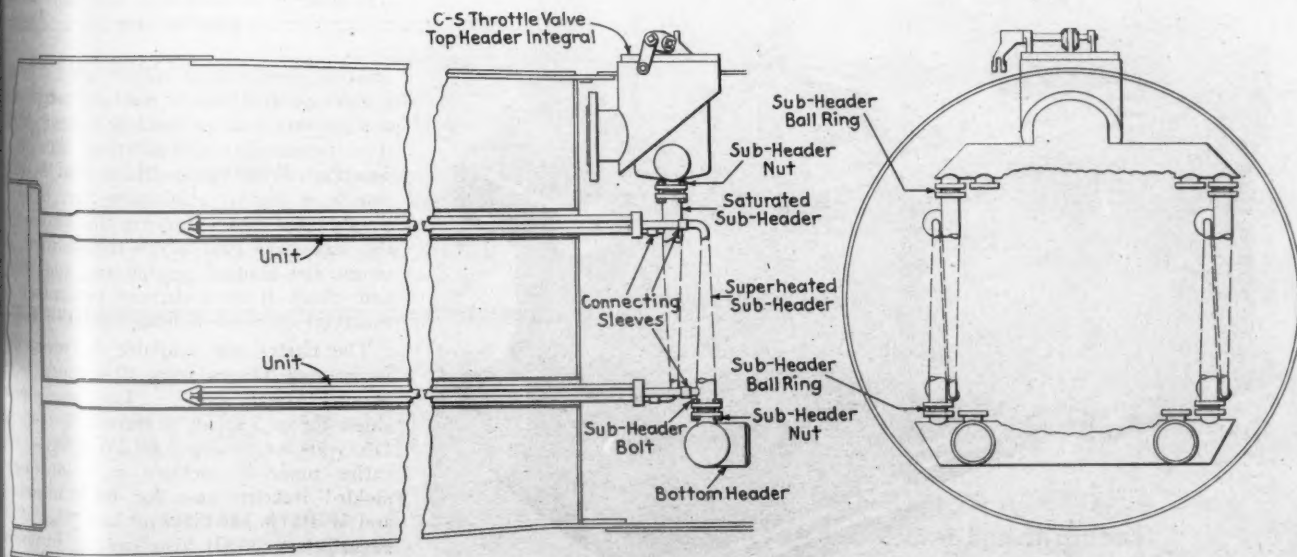
The small number of joints and accessibility contribute to low maintenance cost. No special tools are required. All joints can be ground together and the only machined surfaces which require maintenance are at the ball flanges.

Plastic Battery Retainer

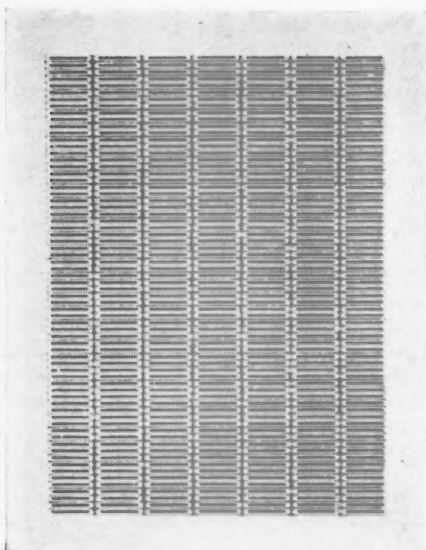
A slotted plastic storage battery retainer manufactured from polystyrene is now being used by The Electric Storage Battery Co., Philadelphia, Pa., for certain types of Exide batteries.

Retainers are a part of the separation or insulation between positive and negative plates and act principally to retain the active material in the positive plates. They play an important part in the performance and life of a storage battery.

The new retainer is said to be more permanent than the former type and also to have other technical advantages. It is the result of extensive field tests, its development having been hastened by the shortage of rubber. Although the basic raw materials used for making the polystyrene re-



A diagrammatic view of the arrangement of the C-S superheater—The headers are also available without throttle valve



The slotted polystyrene retainer is used for certain types of Exide batteries

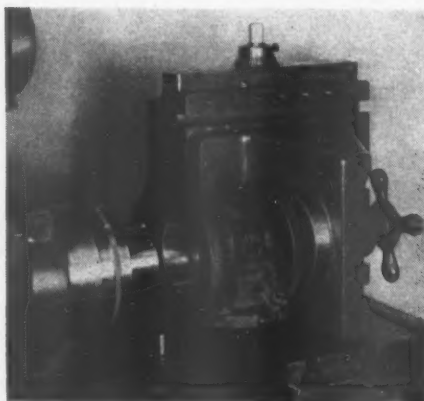
tainer are still on the critical list, it can be manufactured from secondary materials, by-products from the use of this material for other war purposes.

Reconditioning Worn Air Brake Parts

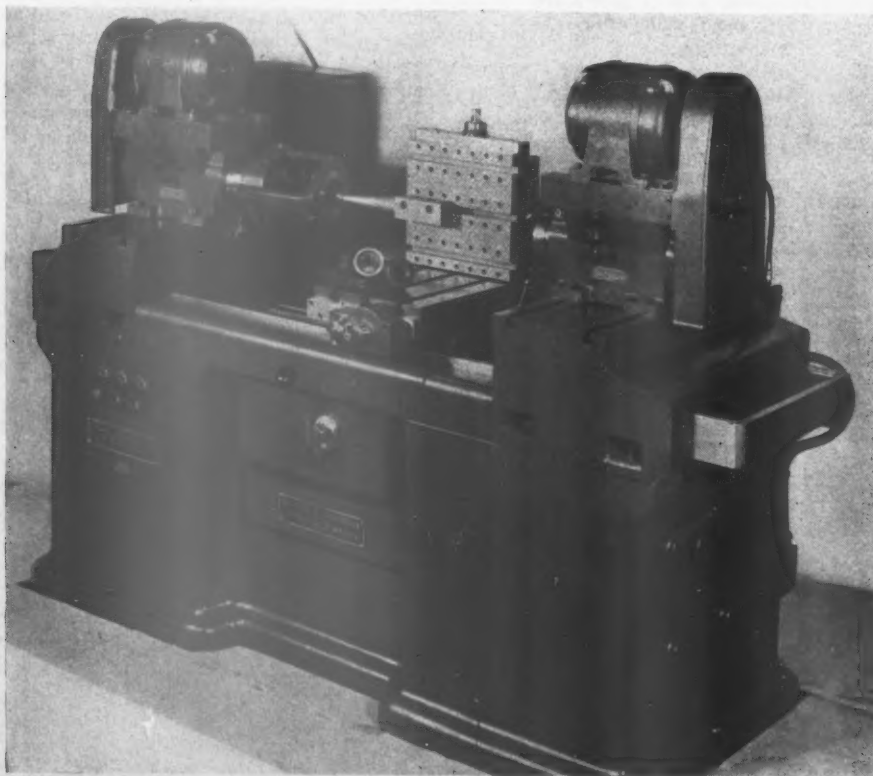
The use of a precision boring machine with the necessary fixtures and gauges is reported to have resulted in the reclama-

tion of many air brake parts which formerly were scrapped when abrasive lapping operations were depended upon to restore worn surfaces to required dimensions for reapplication. The machine, built by the Ex-Cell-O Corporation, Detroit, Mich., has enabled one large railroad system to centralize the repair of all such parts subject to reclamation at a saving in cost per unit, with closer adherence to required tolerances.

When the installation of the machine was first made attention was directed primarily to the reclamation of tapered bodies and keys for 1 1/4-in. angle cocks. Examination of these parts, which had previously been repaired by abrasive lapping, disclosed an out-of-round condition. In turning down the keys it was necessary in some cases to reduce them to a size too



This set-up is used for the straight boring of bushings in triple, automatic control, universal, distributing, AB reducing and feed valve bodies



Machine with universal fixture used for boring angle cock bodies

small in diameter to fit the reclaimed bodies. However, bodies were rebushed and bored to size so that the undersize key could be fitted to them. The present practice is to grade parts according to size in this way oversize and undersize parts formerly scrap, are now made serviceable. The use of check gauges simplifies the mating of parts and re-assembly operations. This selective repair and assembly is said to have increased production 15 per cent over previous methods.

In all 28 separate parts are now being reclaimed on this one machine using a variety of tools mounted on a universal adjustable fixture.

Percentage Timer

A percentage timer which automatically controls the percentage of time at which any a.c. circuit can periodically be closed or opened out of a definite length of a time cycle has been made available by The R. W. Cramer Company, Inc., Centerbrook, Conn. The timers are designed for controlling proportionate flow of chemicals for boiler feed water treatment or any application where one function bears a definite time relation in percentage or operation of a second function. It has a self-



The timer is enclosed in a dust-tight molded Bakelite case

starting synchronous motor which drives a cam-operated switch mechanism through the medium of an enclosed gear train. The percentage of operating time is a function of the motor-driven cam in relation to a similar stationary cam fixed to a calibrated dial. Varying the position of the stationary cam alters the relation between the contact mechanism and opens and closes it at a definite percentage of the total cycle as indicated on the dial.

The timers are available in seven different time ranges from 30 seconds to 60 minutes total cycle. The single-pole, single-throw contact is rated 10 amp. at 115 volts or 5 amp. at 230 volts. The entire timer is enclosed in a dust-tight molded Bakelite case for flush mounting and is 3 1/4 in. in diameter and 3 3/8 in. in overall length. It also can be furnished with various types of surface-mounting steel connection boxes.

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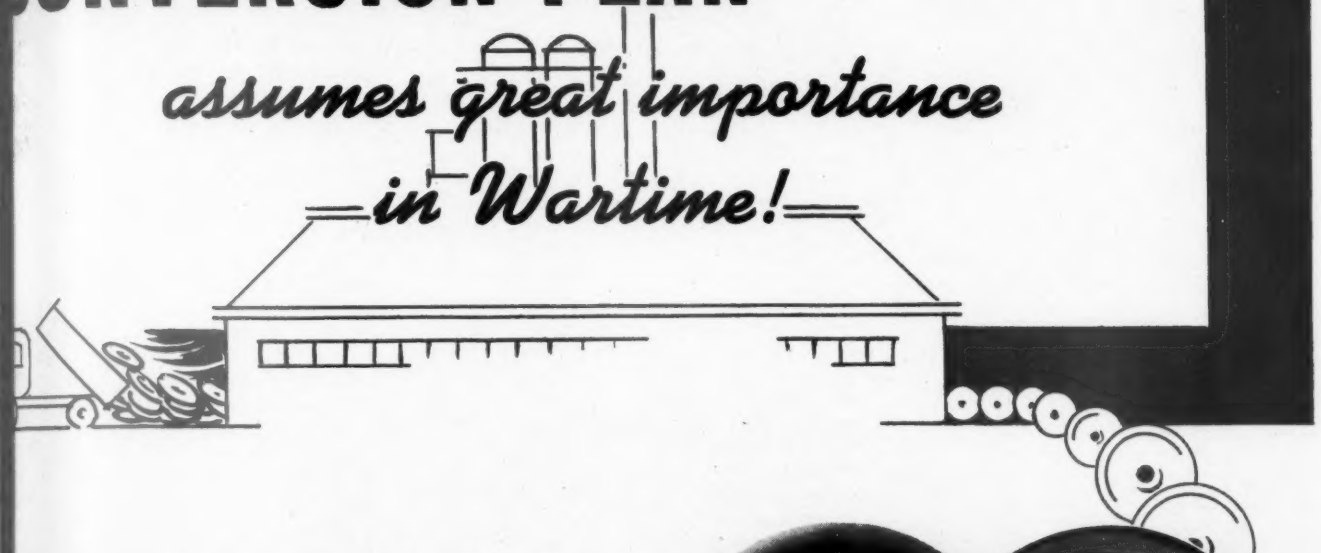
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 al Engineer
 JULY, 1943

THE CHILLED CAR WHEEL CONVERSION PLAN

*assumes great importance
—in Wartime!—*



Uncle Sam has asked us all to save vital metals. Is there any group, other than the Manufacturers of Chilled Car Wheels, that reuses 88.38 per cent of its product? Only 11.22 per cent of the total metal used in the production of the 2,682,000 Chilled Car Wheels delivered to the railroads of the United States and Canada in 1942 was new pig-iron!



Under our wheel exchange plan, by which the railroads receive new Chilled Car Wheels for old on a conversion charge basis, scrapped chilled wheels are speedily recast into new wheels. And, with 38 foundries strategically located in the United States and 8 in Canada, the railroads are assured of quick delivery and minimum delivery costs of Chilled Car Wheels.

1942 CHILLED CAR WHEEL PRODUCTION:
 2,682,000 Chilled Car Wheels were delivered in 1942.
 885,020 Tons of metal were used to make them.
 Of these:
 782,181 Tons or 88.38% were scrapped wheels.
 99,299 Tons or 11.22% were new pig-iron*.
 3,540 Tons or .40% were alloys.
 This IS Salvaging Scrap for the War Effort!
*Secured with the cooperation of W.F.B.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE,
 NEW YORK, N. Y.
 448 N. SACRAMENTO BLVD.,
 CHICAGO, ILL.



ORGANIZED TO ACHIEVE:
 Uniform Specifications
 Uniform Inspection
 Uniform Product

High Spots in Railway Affairs...

Retirement Board Activities Reduced

There has been a considerable curtailment in the activities of the Railroad Retirement Board during the fiscal year which closed June 30. This is accounted for, according to M. W. Latimer, chairman of the board, by a decline in the retirement claims filed and the manpower difficulties of the railroads, which slowed down the receipt of records required for the prior service program. There was also a drastic decline in the receipt of claims for unemployment insurance. It is said that these payments are expected to be about 20 per cent less in the 1943 fiscal year, as compared to 1942 figures. The Railroad Retirement Board's personnel was reduced by about 27 per cent during the year.

Freight Traffic Growing

It is now generally recognized that freight car loading figures no longer form a good measuring stick for the amount of freight business being handled by the railroads. Revenue ton-miles furnish the best basis of comparison, but these statistics naturally lag far behind the car loading figures. The revenue ton-mile figures for Class I railroads for April of this year exceeded those of April, 1942, by 18 per cent. During the first four months of this year the Class I railroads performed 26 per cent more revenue ton-miles of service than in the same period last year. Compared with the first four months of 1939, the increase was 138 per cent.

Oil Movement

The movement of oil to the East Coast by the railroads reached its high point in the week ending May 15, when they delivered an average of more than 980,000 barrels a day of petroleum and petroleum products in tank cars. In addition to this, kerosene in drums loaded in box cars accounted for 17,239 barrels a day. The floods slowed up this movement, although the railroads made an excellent showing by going to unusual lengths to keep the oil moving. The fact that it is handled largely in solid trainloads made it possible to keep close track of the movement and simplified the problem of detouring the trains and speeding up the movement wherever possible. The situation was complicated by damage to the "Big Inch" pipe line from Longview, Texas, to Norris City, Ill. For the week ended June 5 the oil movement continued to climb back to the pre-flood level. The daily average in tank cars was 898,744 barrels and kerosene in drums amounted to 9,699 barrels per day.

The Grain Movement

While the storage facilities problem in handling the wheat crops in the West is always a troublesome one, the situation in this respect this year is said to be better than that of a year ago. The problem this year is one of car supply, and of labor to get the wheat from the farms and to load and unload the cars. In Wichita, Kan., for instance, where the elevators must compete for labor with the local airplane plants, it is reported that in one elevator alone, where 20 power unloader shovel operators are ordinarily employed, only two men are available for this work this year. From the railroad standpoint, military transportation is requiring such a large percentage of the equipment that there has been no possibility of storing surplus cars in the wheat territory, ready to move the grain promptly as it is harvested. It is reported that it may be necessary to store much of the wheat on the ground temporarily to await the time when it can be moved to the local elevators, and in turn be transferred to the grain centers.

Railroads Complimented for Their War Performance

Major General C. P. Gross, Chief, Transportation Corps, U. S. Army, recently gave the New York Chamber of Commerce a dramatic picture of the part that transportation is playing in the present war. "Mechanized warfare," he said, "requires tremendous transportation capacity. It takes 75 trains and 2,700 cars to move an armored division with its 3,700 odd vehicles by rail, and to move it overseas with its reserve complement of equipment and supplies, takes at least 15 Liberty ships in addition to the necessary troopships." In comparing conditions with the first World War he pointed out that the operations at that time were concentrated in a single theatre and shipping was largely confined to the North Atlantic. Today, our operations embrace the seven seas and spread to every corner of the globe. We literally cover the earth. In discussing the various agencies that are involved in the splendid transportation record that is being made, the General had this to say of the railroads: "Moreover, this war found the railroads of this country splendidly organized under a voluntary central control agency known as the Association of American Railroads, and it has responded magnificently to every call. The railroads are carrying from three to four times as much army freight as they did in 1917 and 1918 and they are doing it with 20,000 fewer locomotives and 500,000 fewer freight cars."

Western Railroads Face Difficult Task

Our military operations in the Pacific have thrown an unexpectedly heavy load upon the western railroads. While they have thus far stood up pretty well under this impact, it seems apparent that it is only a starter and that they must prepare for a very much greater increase in traffic as the war with Japan develops. Col. C. R. Lasher, deputy chief of the Transportation Control Division of the Army Transportation Corps, in addressing a meeting of the Trans-Missouri-Kansas Shipper's Board, pointed out that the war with Japan will "mean the bitterest kind of sustained campaign." He said that our forces in the western Pacific will eventually be built up to many times their present strength. This will necessitate an increased flow of freight and passenger traffic westward and a heavier load on top of the heavy one which the western railroads are now carrying. The conflict in the Pacific is undoubtedly responsible for part of the longer freight and passenger hauls reported by the American railroads in 1942. According to Colonel Lasher, the average haul of War Department freight was approximately 700 mi., compared with 450 mi. for the country as a whole; the average distance traveled by each soldier on a trip was 800 mi. compared to 120 mi. for the entire nation.

Vacation Travel

While the O. D. T. apparently does not consider vacation travel essential, it seems inclined to give it preference over the more obviously unessential items—to a certain extent it leaves the decision to the patriotic judgment of the individual. If people feel that their vacation travel is justified, then the O. D. T. asks them to take the following ten rules into consideration: 1. Take the vacation, if possible, in the fall or winter and not in July or August, when travel normally increases. 2. Take the whole vacation at one time; do not split it up into several short periods or a number of weekends. 3. Begin and end the vacation on a Tuesday, Wednesday or Thursday. 4. Spend the vacation as near home as possible. 5. Go to one place and stay there. Travel on day coaches, carry box lunches on trains to avoid putting a further burden on Pullmans and dining cars, and avoid overnight trips. 6. Carry as little baggage as possible and check the heavy pieces. 7. Plan to allow for transportation contingencies requiring last-minute changes. 8. Be prepared to expect delayed arrivals, crowded conditions, and lack of the usual travel comforts. 9. Remember most supplementary services to resort areas will not be running this year.



Joints under pressure are made steam tight at Lima. By such attention to details Lima has won a reputation for soundness of construction that backs up its leadership in locomotive design.

★ SERVICE ... *the proving ground of locomotives*

The long, grueling service under which locomotives have been operating for the past few years is a worthy proving ground of soundly-built locomotives.

Lima-built locomotives have long had a reputation for high performance and for low maintenance. And today this reputation is being further augmented by the high "availability" of Lima power.

The ability of Lima-built locomotives to "take it" is due in great measure to the many special methods and tools that have been developed at Lima to insure greater accuracy of manufacture and resultant higher degree of availability.

LIMA LOCOMOTIVE WORKS



INCORPORATED, LIMA, OHIO

NEWS

Lawford Fry Becomes Research Director

LAWFORD H. FRY has resigned as railway engineer of the Edgewater Steel Company, Pittsburgh, Pa., to become director of research of the Locomotive Institute, New York.

Mr. Fry was for many years associated with the Baldwin Locomotive Works and has a wide reputation for his contributions and ability in the field of locomotive design and construction. He is a Fellow of the American Society of Mechanical Engineers and at its 1938 annual meeting was



Lawford H. Fry

awarded the Worcester Reed Warner Medal for "written contributions relating to improved locomotive design and utilization of better materials in railway equipment." He is the author of a book, *A Study of the Locomotive Boiler*, and has contributed a large number of articles and papers on locomotives and on metallurgical subjects to engineering societies and to the technical press of this country and England.

Mr. Fry is a member of the American Society for Testing Materials and is a member of its executive committee. He is also a member of the following British institutions: The Institution of Civil Engineers, the Institution of Locomotive Engineers, and the Institution of Mechanical Engineers. In 1928 he was the recipient of a T. Bernard Hall prize for his paper, *Experiments with a Three-Cylinder Compound Locomotive*. He is also a member and has been active in the Newcomen Society.

Mr. Fry was born in Richmond, Province of Quebec, Canada, and obtained his technical training at the City and Guilds of London (England) Technical Institute,

the University of Goettingen, and the Hannoversche Technische Hochschule. He was in the shops of the Baldwin Locomotive Works, 1897 to 1899; sales engineer, 1904; and engineer of tests, 1905. He then became European technical representative of the company. Returning to this country in 1913, he became head of the metallurgical department, Standard Steel Works, Burnham, Pa., and remained there as metallurgical engineer until 1930.

A. A. R. Board Approves Technical Research

CREATION of a central research organization, under the management of a director of technical research, to engage in fundamental, basic research with a view to possible improvement in the engineering and mechanical aspects of railroading has been authorized by the board of directors of the Association of American Railroads.

More Steel Expected in Third Quarter from WPB Drive

INCREASED allotments of steel to the railroad industry is expected to result from the War Production Board's drive to increase steel production by 1,000,000 ingot tons in the third quarter. The drive is under way as a result of a demand from War Mobilization Director Byrnes, who is understood to have acted upon representation from the armed forces.

Most of the increased production is therefore expected to be allotted to the Army and Navy, but the railroads are nevertheless expected to get a "substantial" increase in their current allotment for the third quarter. Details of the latter with respect to the equipment situation were reported on page 293 of the June *Railway Mechanical Engineer*.

Proceedings

THE 1942 Proceedings of the Car Department Officers' Association are now available from the secretary-treasurer, F. H. Stremmel, assistant to secretary, Mechanical Division, Association of American Railroads, 59 East Van Buren street, Chicago, at a cost of \$2.

Burlington Material Being Used in Navy Cars

MATERIAL which the Chicago, Burlington & Quincy had on hand at the beginning of the war for the construction of freight cars in its own shops, and which was frozen by the War Production Board, is being used in the construction of cars for the Navy. A contract for the construction of 170 special box cars has been placed with the Navy with the Burlington on a non-profit basis and about 90 per cent of the material used in their construction is coming from the frozen stock piles. The cars which are being built at the Havelock, Neb., shops at the rate of ten a day, will be 50½ ft. long and will have 10-ft. doors and special interior fittings for handling naval supplies.

Loftis Appointed Assistant to Boatner in ODT

J. D. LOFTIS, JR., mechanical assistant in the Division of Railway Transport, Office of Defense Transportation, has been appointed assistant to Director V. V. Boatner of the Division, succeeding James F. Haley, who resigned to accept a commission in the Air Transportation Corps.

A Supply Company Becomes a General Research Agency

STARTING with a few special instruments needed in the study of problems related to the development of its own products, the Waugh Equipment Company, New York, has gradually expanded the scope both of the instruments and personnel with engineering training until Waugh Laboratories are furnishing both for test investigations in defense production as well as in other private industries. Starting with such equipment as the car impact test plant, a 9,000-lb. drop hammer for testing draft gears, impact registers, and the simple scratch-type strain gages with which the railway field is familiar, there has been a gradual accumulation in the laboratory of a wide variety of instruments adapted for the investigation of problems in many other fields, including bridge engineering.

(Continued on next left-hand page)

Orders and Inquiries for Equipment Placed Since the Closing of the June Issue

Road	LOCOMOTIVE ORDERS		Builder
	No. of Locos.	Type of Loco.	
Bingham & Garfield	2 ¹	Mallet	Baldwin Loco. Works
Chesapeake & Ohio	10 ²	Mallet	Lima Loco. Works
Chicago, Rock Island & Pacific	10 ³	4-8-4	American Loco. Co.
Indianapolis Union	3	0-8-0	Baldwin Loco. Works
Pittsburgh & Lake Erie	25 ⁴	0-8-0	American Loco. Co.

¹ Duplicates of 20 ordered recently from the same builder.

² To cost approximately \$2,750,000. Delivery is scheduled to begin the first quarter of 1943. The new engines will haul freight over mountains between Clifton Forge, Va., and Hinton, W. Va. and will be similar to 20 locomotives placed in service on that route during 1941 and 1942.

³ Purchased authorized by the District Court at Chicago.

⁴ Approximate cost, \$2,000,000.

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Booster Power keeps *war goods* moving

When extra cars are added the Booster-equipped locomotive gets the train started.

When a combination of bad rail and grade is slowly stalling a heavy train, the added power of the Booster* comes to the rescue.

Engineers of Booster-equipped locomotives bear witness to hundreds of instances like these, where the extra power of the Locomotive Booster has kept traffic moving.

Thousands of Booster-equipped locomotives are helping speed war-time traffic.





Test being made with magnetic strain gages employing the Waugh switching unit for aid in measuring strains

steel structures, the behavior of reinforced concrete under load, the oil industry, marine engineering, airplane design, and studies in the development of military combat materiel, including automotive vehicles.

The laboratory equipment includes a particularly wide variety of strain-measuring instruments, both of the scratch type and various electrical and electro-magnetic types, with auxiliary equipment adapted for use in the study of records and for the convenient and rapid reading of strain measurements when they are being made

at a number of locations on a structure. For dealing with vibrations and noise measurement, the equipment ranges from the Bernhard mechanical oscillator capable of setting up oscillating forces up to 20,000 lb. for the study of the effect of periodic vibrations in bridges, ships, and other structures, to sound-level meters for the measurement of high frequency oscillations in a wide range of fields, not excluding sound and other vibratory phenomena in steam railway equipment.

As the variety of instruments which

were available in the Waugh Laboratories gradually increased, they have been utilized for various engineering studies, at first by the railroads and, since the beginning of the war, by many other industries. Some of the instruments are commercially available; others, however, were developed in the laboratories to meet special requirements and are not available elsewhere. This applies particularly to a number of the instruments employing magnetism and electrical resistance for the measurement of stress and high-frequency vibrations.

This is a case of a railway supply industry furnishing facilities for research in other fields of transportation which, in the public mind, are much more frequently associated with research than are the railway and railway supply industries.

A. S. M. E. and Pacific Railway Club Hold Joint Session

THE Pacific Railway Club joined with the Railroad Division of the American Society of Mechanical Engineers in a discussion of some of the post-war problems of the railways at a session on June 15 during the semi-annual meeting of the A. S. M. E., held at Los Angeles, Calif., June 14 to 17. Two papers were presented and discussed, one on railway equipment needs, characteristics and design of the post-war era, by L. F. Etter, head of the service department, Pacific Railway Equipment Company, Los Angeles, and the other on the influence of new materials and machinery on post-war railway freight equipment, by Morris P. Taylor, assistant mechanical engineer, Southern Pacific, San Francisco, Calif. The session was opened by H. S. Wall, mechanical superintendent, Atchison, Topeka & Santa Fe, vice-president of the Pacific Railway Club, who turned the meeting over to Paul K. Beemer, chief engineer, Pacific Railway Equipment Company, representing A. S. M. E.

Supply Trade Notes

NATIONAL MALLEABLE & STEEL CASTINGS CORPORATION.—*Walton L. Woody* has been elected vice-president in charge of operations of the National Malleable & Steel Castings Co., with headquarters at Cleveland, Ohio. Mr. Woody was formerly assistant to the president in charge of the Sharon, Pa., and Melrose Park, Ill., works. A sketch and photograph of Mr. Woody appeared in the February issue at the time of his appointment to the latter position.

GOULD STORAGE BATTERY CORPORATION.—*John C. Sykora* has been appointed vice-president, and *Roy J. Stanton*, motive power sales manager, of the Gould Storage Battery Corporation at Depew, N. Y.

John C. Sykora has been with the Gould organization for nearly a quarter of a century, having entered the New York office in 1919. Eight years later he was trans-

ferred to Depew as assistant to the general sales manager. Mr. Sykora has made his headquarters in Depew since 1927, except for one year when he acted as special representative of the Gould Company in Washington, D. C. He was appointed sales manager in 1940.

Roy J. Stanton, formerly employed for a number of years by the United States Light & Heat Corporation, became a member of the Gould sales force when Gould took over the industrial division of U. S. L. He first covered several different territories for Gould and later assumed charge of the company's Detroit office. In his new position he will make his headquarters at Depew.

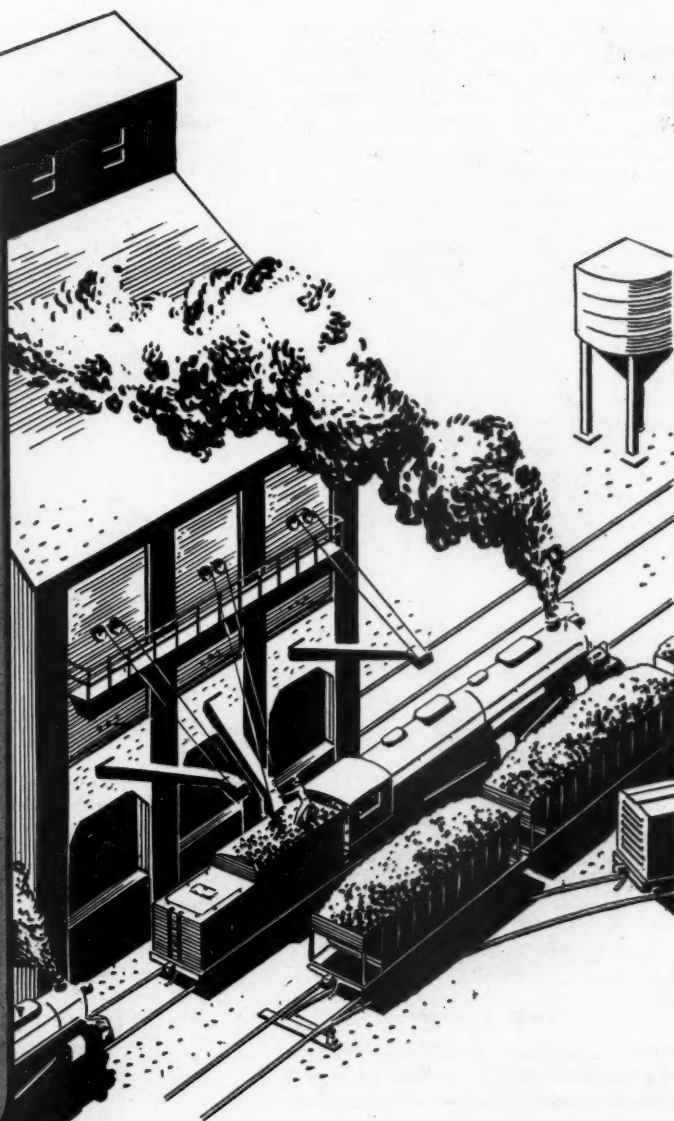
GISHOLT MACHINE COMPANY.—*C. K. Swafford*, works manager and a member of the board of directors of the Gisholt Machine Company, Madison, Wis., has been elected a vice-president of the com-

pany. Mr. Swafford entered the employ of the Gisholt company in 1913. Shortly after the United States entered the first World War, he was transferred to other activities, returning to the company in 1930 as works manager. He continues to serve also in this capacity.

ALLEGHENY-LUDLUM STEEL CORPORATION.—*Robert H. Gibb*, manager, Pittsburgh district sales office of the Allegheny-Ludlum Steel Corporation, has accepted a commission in the United States Navy, and the duties formerly performed by him will be taken over by *Max Pischke*, who will have the title of acting district manager. Mr. Gibb has been in the Pittsburgh district sales office for several years, having served as assistant district manager there until his appointment to the managership in January, 1943. Mr. Pischke has been with the Allegheny-Ludlum Pittsburgh sales office for the past two years.

Here's help in
maintaining

*Fuel
Burning
Efficiency*



More than 30 years ago the fundamental value of the Security Sectional Arch in increasing coal-burning efficiency was established by railroad men themselves.

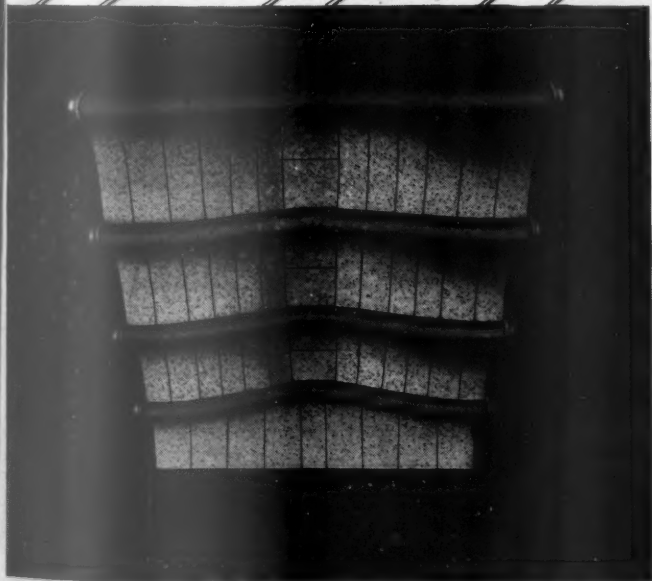
Make sure that full use is being made of this proved help in obtaining the maximum steam production from each pound of war-time fuel.

This means a complete arch in every locomotive in service.

HARBISON-WALKER REFRACTORIES CO.
Refractory Specialists

AMERICAN ARCH COMPANY, INC.
60 EAST 42nd STREET, N. Y.

Locomotive Combustion Specialists



INDEPENDENT PNEUMATIC TOOL COMPANY.—Neil C. Hurley, whose election as executive vice-president of the Independent Pneumatic Tool Company, Chicago, was reported in the May issue of the *Railway Mechanical Engineer*, graduated from Notre Dame in 1932, and in the same year entered the service of the Independent Pneumatic Tool Company. In 1935 he was promoted to secretary, and four years later was elected vice-president and a director, holding the former position until his new appointment, effective April 1.

AMERICAN BRAKE SHOE COMPANY.—George L. Rieger has been appointed assistant general superintendent of the Ramapo Ajax Division of the American Brake Shoe Company, with headquarters at 230 Park avenue, New York. Roy L. Salter



George L. Rieger

has been appointed general superintendent of the Southern Wheel division of American Brake Shoe Company, with headquarters at the company's New York offices.

George L. Rieger was born in 1891. He joined the Ajax Forge Company in July, 1916, as a planer hand and a few years later was transferred to the company's Chicago plant as assistant foreman. He was promoted to the position of foreman in 1927 and transferred to the Los Angeles plant. A year later he was transferred back to Chicago as general foreman. Mr. Rieger was appointed superintendent of the Ramapo Ajax plant at Hillburn, N. Y., in 1940, serving in that capacity until his promotion to assistant general superintendent at New York.

SKF INDUSTRIES, INC.—Robert R. Zisette, for the past year assistant sales manager, has been promoted to the position of general sales manager of SKF Industries, Inc., Philadelphia, Pa. Mr. Zisette has been in the employ of the company since 1921, serving as sales engineer in the Cleveland, Ohio, office, and district manager of the Cincinnati office.

IRON & STEEL PRODUCTS, INC.—Frank Parker, president of Iron & Steel Products, Inc., Chicago, has been elected chairman of the board, and has been succeeded by Albert G. Bladholm, secretary. John F. Parker, vice-president, has been elected

vice-president and treasurer; William J. Parker, vice-president, has become vice-president and secretary and Royal J. Casper has been appointed assistant secretary.

Frank Parker entered the employ of the Republic Iron & Steel Co., in 1905 and in 1917 resigned from the position of general



Frank Parker

superintendent, Western division, to engage in the scrap-iron and general iron and steel salvage and equipment business. In 1930 he formed Iron & Steel Products, Inc.

Albert G. Bladholm entered the scrap-iron and general iron and steel salvage and equipment business in 1923. In 1930 he



Albert G. Bladholm

assisted in forming Iron & Steel Products, Inc., and became its secretary, the position he was holding at the time of his recent election.

Army-Navy E Awards

American Locomotive Company, Latrobe, Pa. May 25.

Ampco Metal, Inc., Milwaukee, Wis. May 16.

Climax Engineering Company, Clinton, Iowa. May 7.

Gustin-Bacon Manufacturing Company, Kansas City, Kan. June 18.

Hughes-Keenan Company, Mansfield, Ohio. May 7.

SPERRY PRODUCTS, INC.—Richard D. LaFond has been appointed director of public relations of Sperry Products, Inc., Hoboken, N. J. Mr. LaFond will direct all advertising, publicity, and employee-morale activities for Sperry, in addition to inaugurating an enlarged program of customer-relations designed to make available the benefits of Sperry research and field application data to the railroad, marine and aviation industries. Mr. LaFond, before joining Sperry Products, was sales promotion manager for the Dresser Manufacturing Co., of Bradford, Pa., and prior to that time he was in the industrial advertising section of the General Electric Co., at Schenectady, N. Y.

BALDWIN LOCOMOTIVE WORKS.—V. H. Peterson, for the past two years vice-president of the Elliott Company, has been appointed assistant to the president of the Baldwin Locomotive Works. Mr. Peterson was educated in the public schools of Waterbury, Conn., and started work as a



V. H. Peterson

draftsman for the Scovill Manufacturing Company of that city. He attended the continuation school conducted by the industries of Waterbury, and won a scholarship which enabled him to enter Rensselaer Polytechnic Institute of which he was a graduate, with a degree in mechanical engineering, in 1925. Mr. Peterson entered the service of the Elliott Company and, in 1938, after having served as sales engineer in the Pittsburgh office and as district manager of the Rochester and Washington, D. C., offices, he went to Jeannette, Pa., as assistant to the president in coordinating the sales activities of the company. In 1941 he was elected a vice-president of that company, with responsibility for all sales, advertising and service activities of their three plants.

EDGEWATER STEEL COMPANY.—William J. George has been appointed assistant to the president in charge of products engineering for the Edgewater Steel Company, Pittsburgh, Pa. Harry C. Riddile has been appointed superintendent of the Ring Mill and Ring Spring departments.

INLAND STEEL COMPANY.—James S. Gregg has been appointed district sales manager of the Cincinnati, Ohio, sales office of the Inland Steel Company. Mr.

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Gregg, until his recent transfer to Cincinnati, covered the Wisconsin territory out of the company's Milwaukee sales office. He had been associated with Inland Steel since October 1, 1935. Prior to that time he was employed by the Moise Steel Company, Milwaukee, Wis. Kenneth J. Burns, who formerly headed the Cincinnati sales office, is now located in an executive capacity in the company's Plate and Shape sales division in Chicago.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—Charles A. Hook, president of the American Rolling Mill Company, and Elisha Walker, partner in the firm of Kuhn, Loeb & Co., have been elected to the board of directors of the Westinghouse Electric & Manufacturing Co.

NATIONAL LOCK WASHER COMPANY.—Arthur W. Preikschat, manager of the car equipment division of the National Lock Washer Company, Newark, N. J., has been appointed vice-president in charge of manufacturing of the company, with headquarters at Newark.

J. H. WILLIAMS & COMPANY.—The Stock Products sales offices of J. H. Williams & Company have been moved from 225 Lafayette street, New York, to the company's plant at Buffalo, N. Y. A sales office will be maintained at the Lafayette street address to serve the Metropolitan area only.

Obituary

DANA RIPLEY BULLEN, retired assistant to the vice-president of the General Electric Company, Schenectady, N. Y., died recently at the age of 78.

FRED W. VENTON, treasurer of the Allied Railway Supply Association and manager of the railroad sales department of the Crane Company, Chicago, died in that city on May 26.

HARRY GLAENZER, vice-president in charge of engineering of the Baldwin Locomotive Works until his retirement in 1940, died on May 24. After being educated in the technical schools of Balti-

more, Md., and at the University of Pennsylvania, Mr. Glaenzer became associated with the engineering department of Bald-



Harry Glaenzer

win in March, 1899. He was appointed chief engineer in 1921, and was elected vice-president in charge of engineering a year later.

Personal Mention

General

R. C. KEENAN has been appointed supervisor of apprentices of the Erie, with headquarters at Cleveland, Ohio.

F. C. RUSKAUF has been appointed assistant to general superintendent of motive power of the New York Central, with headquarters at New York.

A. L. OLSON, chief draftsman of the Chicago, Rock Island & Pacific at Silvis, Ill., has been appointed assistant mechanical engineer, with headquarters at Silvis, Ill.

W. C. BOWRA has been appointed assistant superintendent motive power and car equipment of the Montreal district of the Canadian National, at Montreal, Que.

DUMONT LOVE, who has been appointed general mechanical inspector of the Florida East Coast, with headquarters at St. Augustine, Fla., as noted in the June issue, was born in Shenandoah, Iowa. He entered the service of the Florida East Coast as a locomotive engineman in 1912, and served subsequently as road foreman of engines before becoming superintendent of air brakes at St. Augustine, the position he was holding at the time of his appointment to general mechanical inspector.

T. L. NICHOLS, master mechanic of the Atlanta & Saint Andrews Bay, has been appointed superintendent of motive power, with headquarters as before at Panama City, Fla. Mr. Nichols was born on December 15, 1900, at Chester, S. C., and attended Furman University, Greenville, S. C., for two years. Prior to his entering the service of the Atlanta & Saint Andrews Bay, he was employed by the Caro-

lina & Northwestern, Southern, and the Norfolk & Western, successively.

A. F. LEPLA, assistant mechanical engineer of the Chicago, Rock Island & Pacific, at Silvis, Ill., has been appointed mechanical engineer, with headquarters at

A. H. GLASS, mechanical assistant, operators, of the Chesapeake & Ohio, New York, Chicago & St. Louis, and the Pere Marquette, has been appointed chief motive power inspector of the Chesapeake & Ohio, with headquarters at Richmond, Va.

Master Mechanics and Road Foremen

J. D. HARLEY has been appointed master mechanic of the Savannah & Atlanta, with headquarters at Savannah, Ga.

J. J. NELSON has been appointed master mechanic of the Buffalo division of the Delaware, Lackawanna & Western, with headquarters at East Buffalo, N. Y.

L. B. JOHNSON, master mechanic of the Slaton division of the Atchison, Topeka & Santa Fe, has been transferred to the Pecos division with headquarters at Clovis, N. M.

W. W. LYONS, master mechanic of the Pecos division of the Atchison, Topeka & Santa Fe, has been transferred to the Western division, with headquarters at Dodge City, Kan.

H. E. ANDERSON, master mechanic of the Western division of the Atchison, Topeka & Santa Fe, has been transferred to the Slaton division with headquarters at Slaton, Tex.

H. C. FOSTER has been appointed road foreman of engines of the Chesapeake & Ohio, with headquarters at Clifton Forge, Va.

T. M. CONNIFF, master mechanic of the Buffalo division of the Delaware, Lackawanna & Western at East Buffalo, N. Y., has been transferred to the Morris and Essex division, with headquarters at Hoboken, N. J.

N. C. WARD has been appointed master mechanic of the Tallulah Falls with headquarters at Cornelia, Ga.

H. F. DEERY has been appointed road foreman of engines of the Baltimore & Ohio, with headquarters at Riverside, Baltimore, Md.

JAMES PURCELL, master mechanic of the Morris and Essex division of the Delaware, Lackawanna & Western at Hoboken, N. J., has been commissioned a lieutenant colonel of the Railway Shop Battalion, United States Army.

H. C. FOSTER, traveling fireman on the Hinton division of the Chesapeake & Ohio, has been appointed road foreman of engines of the Allegheny, Greenbriar and Hot Springs sub-divisions, with headquarters at Clifton Forge, Va.

RICHARD DUVAL SMITH, master mechanic of the Interstate Railroad Company at Andover, Va., retired on July 1. Mr. Smith was born on February 5, 1874, at Lynchburg, Va. He attended Bell Heights Academy, Radford, Va., and on May 1, (Continued on second left-hand page)

Major Economies



General Motors 600 Hp.
Diesel Switcher



General Motors 6000 Hp.
Diesel Road Locomotive



General Motors 5400 Hp.
Diesel Freight Locomotive

Follow **GM DIESEL EXPANSION**

General Motors Diesel Locomotives have definitely established their superiority in switching, transfer, freight and passenger service, providing — reduction in train miles as much as 50 percent — greater tonnage-hauling capacity — higher availability — faster schedules — lower operating costs — increased revenues.

Railroads can now realize further major economies which logically follow the complete Dieselization of an entire railroad or section of a railroad, such as — fewer locomotives required — fewer terminals required — elimination of costly water-treating plants — water towers — track pans — coaling plants — cinder pits — replacement of large and costly engine-house and backshop facilities with small, modern, efficient but inexpensive maintenance plants.

The ever-increasing displacement of steam power with GM Diesels in all classes of service is a natural process of evolution — **PROGRESS.**

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION
LA GRANGE, ILLINOIS, U.S.A.



1888, entered the service of the Norfolk & Western as an apprentice. He was subsequently employed as a machinist, assis-



R. D. Smith

tant foreman, and general foreman until May 1, 1922, when he became master mechanic of the Interstate Railroad Company.

HAROLD E. NIKSCH, who became division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific in February of this year, as noted in the April issue, was born on February 1, 1903, at Harvey, Ill. He received the degree of B.S. in M.E. at Armour Institute of Technology, of which he was a graduate in 1924. He entered the employ of the Milwaukee in July,



Harold E. Nicksch

1924, as a special apprentice and in November, 1927, became mechanical inspector in the test department. He was appointed assistant engineer, budget department, in December, 1930; mechanical assistant, budget department, in February, 1939; special representative to chief operating officer in January, 1941; assistant to superintendent of motive power in April, 1942, and division master mechanic in February, 1943.

Car Department

B. J. WEISMER, car department foreman of the Delaware, Lackawanna & Western at Secaucus, N. J., has been appointed division car foreman at Hoboken, N. J.,

with jurisdiction over the Morris and Essex division.

A. W. PHILLIPS has been appointed master car builder of the Savannah & Atlanta, with headquarters at Savannah, Ga.

Shop and Enginehouse

J. K. MILLHOLLAND, general foreman of the Chesapeake & Ohio at Shelby, Ky., has retired.

R. B. SHEPARD, engine inspector in the employ of the Central of Georgia at Macon, Ga., has been promoted to the position of night enginehouse foreman at Macon.

H. H. NIEMEYER, night enginehouse foreman of the Chicago, Burlington & Quincy at Ottumwa, Iowa, has been promoted to acting general boiler inspector, with headquarters at Chicago, succeeding E. G. Stanciforth, who has been granted leave of absence due to illness.

Purchasing and Stores

J. V. MILLER, assistant general storekeeper of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed manager of stores, a newly created position, with headquarters at Milwaukee, Wis.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

DIE STEEL.—Firth-Sterling Steel Company, McKeesport, Pa. Four-page bulletin descriptive of Cromoco air-hardening die steel for cutting and forming dies and for special applications.

MANGANESE STEEL.—American Brake Shoe Company, Chicago Heights, Ill. Forty-eight page illustrated bulletin, No. 543-G, discusses the properties of manganese steel and its applications in various industries.

RIVET HEATERS; FORGING FURNACES.—Mahr Manufacturing Company, Division of Diamond Iron Works, Inc., Minneapolis Minn. Eight-page bulletin illustrates Mahr line of gas- or oil-fired rivet heaters, with specification data. Sixteen-page bulletin, No. 210, descriptive of different types of forging furnaces, with specification data.

"SPRING DESIGN AND ENGINEERING."—Mid-West Spring Manufacturing Company, 4632 South Western avenue, Chicago. Forty-page manual, complete in formulas of spring design and engineering for compression, extension, torsion, flat spiral or motor, flat springs, wire forms, etc., with illustrations, diagrams and tables. Detachable extension sheets follow "blueprint" diagrams, with spaces for details, and sketches for the use of those interested in writing for data on spring problems.

JACKS.—The Duff-Norton Manufacturing Co., Pittsburgh, Pa. Sixteen-page jack maintenance manual, "Maintenance and Safety Hints." Designed as a reference book for mechanical jack users. Describes basic types of mechanical jacks—screw and ratchet types; how they operate, and construction details with diagrams.

ELECTRICAL INSULATING VARNISH.—The Sterling Varnish Co., Haysville, Pa. A four-page bulletin, No. 143, entitled "Thermobonds," describes a new insulation, specifically for high-speed armatures which may be subjected to excessive heat, heavy overloads, and atmospheres containing acid or alkali fumes and abrasive materials.

WELDING ELECTRODES.—Air Reduction, 60 East Forty-Second street, New York. Comparison chart details principal AWS and ASTM electrode classifications and indicates which electrodes produced by 20 manufacturers meet the different requirements.

TWISTITE PRESSURE UNITS AND C-CLAMPS.—Michigan Clamp Company, Jackson, Mich. Bulletin No. 43. Describes Twistite push-pull pressure units, C-clamps, and holding devices of special design into which Twistite units can be build.

BOLT AND WIRE CUTTERS.—H. K. Porter, Inc., Everett, Mass. Forty-eight-page illustrated booklet shows how to get the best results and longest possible service with Porter bolt clippers for the duration—and after.

MACHINE TOOLS.—Cincinnati Milling and Grinding Machines, Inc., Cincinnati, Ohio. Catalog No. M-995-1; 48 pages, illustrated. Engineering specifications on machines for milling, broaching, die sinking, grinding, and lapping.

ARC WELDERS.—General Electric Company, Schenectady, N. Y. Twelve-page bulletin, GEA-1140J, descriptive of operation and advantages of Type WD direct-current, single-operator arc welders. Illustrations show important construction details and both engine- and motor-driven types of welders at work on various jobs.

STANDARD AND SPECIAL DIES.—Carboly Company, Inc., Detroit, Mich. Thirty-two page cemented carbide die manual and catalog covering standard and special dies for drawing wire, bar, tubing and sheet metal, with detailed recommendations on die shapes for drawing round wire, bar and tubing. Illustrates and lists suggested die-room accessories, supplies and equipment.

"WOOD AND ITS PLACE IN THE WAR EFFORT."—Kay Displays, Inc., 9 East Fortieth street, New York. Spiral-bound book pictures manifold applications of wood and its converted forms to production problems, now for war materials and later for peacetime products. Several case histories are presented, some of which show parts made of bent wood, plywood, and solid wood, engineered and produced in quantities as substitutes for other critical materials.

ANDERSON

Plugs and Receptacles



ANDERSON battery charging equipment is ruggedly constructed to withstand the hardest railroad service. Carefully selected materials plus accurate workmanship characterize every part of our plugs and receptacles. They are made in a wide variety of types to suit every conceivable railroad purpose. We would be pleased to have our engineers collaborate with you on your battery charging problems.

Anderson Plugs and Receptacles are designed for the following:

Air Conditioning	Switchboards
Battery Charging	Welding
Marker Lights	Cable Connectors
Yard Receptacles	Couplers
Platform Receptacles	Watertight Plugs and
Portable Tools	Receptacles
Telephones	Turntables
Industrial Trucks	

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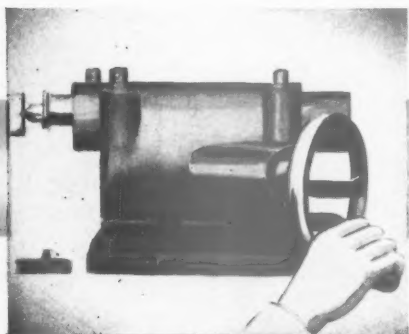
July, 1943

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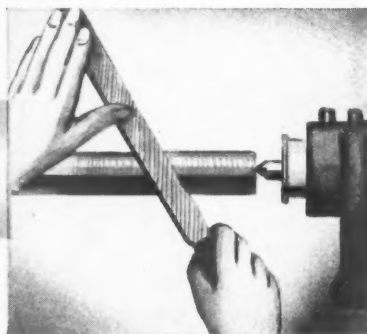
I'm Tellin' You...

No. 12 in a series on "Keeping 'em Turning"
by Charles Carr, 37 years at LeBlond.

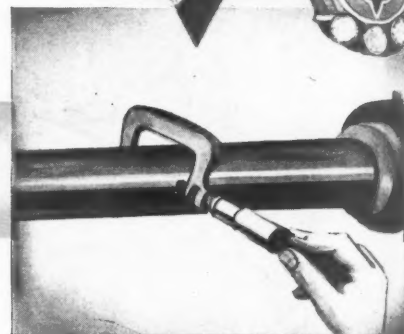
"We old-timers have been passing along the tips on 'Keeping 'em Turning' and we've given you about every important point in the book. But no matter how good a job of turning you've done, it's pretty tough to get a finish smooth enough to be used directly in service. You won't always have a grinding machine available and that's where filing and polishing come in. This is the way an old-timer does it . . ."



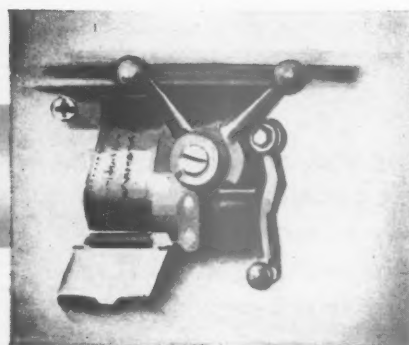
With work set up on headstock center, run tail center up tight, then slack off slightly and start lathe to run at twice finish turning speed, adjusting center to allow dog to click in face plate but not to allow rattle or end shake.



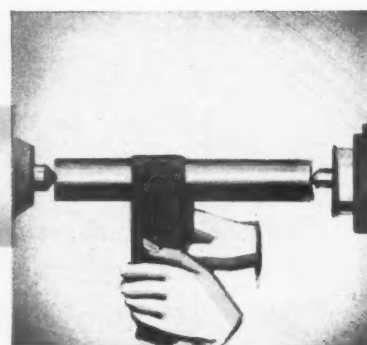
Use a 12-inch mill file with slow, even strokes, lapping from side to side. Use a long, slow forward stroke and press firmly and evenly on the revolving piece being filed. Relieve pressure on return stroke.



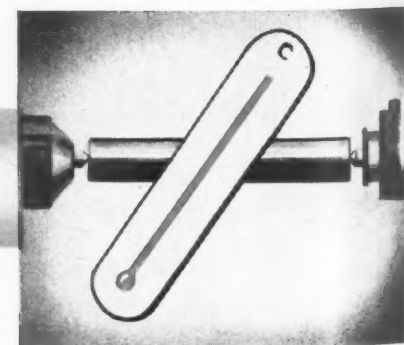
Stop lathe and try diameter with micrometer frequently until whole surface is filed as straight and smooth as possible. Leave from five to eight ten-thousandths (.0005 to .0008) of an inch for polishing the work.



For polishing work that is well-balanced, set change levers to give the highest possible speed. On unbalanced work, run the lathe at highest speed possible without vibration. A speed lathe is best for straight shafts one inch or less in diameter.



Use strip of emery or carborundum paper of fine grade and press against work, moving abrasive cloth from side to side to cross lines and bring work to rough polish without cutting rings. Use very fine abrasive cloth and oil on work for final polish.



Watch out for heat! Remember, polishing and filing heat the work. When measuring with a micrometer, either cool the work by immersing in water or else make an allowance of one or two ten-thousandths of an inch for cooling of work.



THE R. K. LeBLOND MACHINE TOOL CO.
Cincinnati, Ohio

Largest Manufacturer of a Complete Line of Lathes